Construction BMPs

Storm Water Utility

	BMPs to Consider	BMP Criteria							
		General- for all Sites	Hazardous Wastes Used?	Excavation on Flat Surfaces?	Excavation on Slopes?	Water Bodies on Site?	Construction Temporarily Stopped?	Outside Storage Piles?	Post-Constructi on BMPs
	Waste and Material Management								
BRRC	Building, Repair, Remodeling, and Construction	X	X						
CWM	Concrete Waste Management	X	X			X			
EBB	Earth Berm Barrier		X	X	X			X	
HWM	Hazardous Waste Management	X	X						
MS	Material Storage	X	X					X	
MU	Material Use	X	X						X
PT	Portable Toilet	X							
SCU	Spill Clean-Up		X					X	X
WD	Waste Disposal	X	X					X	
	Vehicle and Equipment Management								
EVWA	Equipment and Vehicle Washdown Ar	X							
VEC	Vehicle and Equipment Cleaning	X							
VEF	Vehicle and Equipment Fueling	X							
	Stabilization								
BIO	Bioengineering				X	X			X
CM	Chemical Mulch				X		X		
CP	Compaction	X		X					
CR	Construction Road Stabilization	X		X	X				
CES	Contaminated or Erodible Surface Are			X	X				
DC	Dust Controls	X		X	X			X	
ECB	Erosion Control Blankets			X	X		X		X
FS	Filter Strips	X				X			X
GM	Geotextiles and Mats				X	X	X		X
HM	Hydromulching			X	X				X
MU	Mulching			X			X		X
PEV	Preservation of Existing Vegetation	X			X	X			X
SP	Seeding and Planting			X	X		X		X
SCE	Stabilized Construction Entrance	X							
TPS	Temporary and Permanent Seeding			X			X		X
	Runoff Diversion								
BE	Benching				X			X	
CD	Check Dams				X	X			
DD	Diversion Dike	X			X	X		X	
SD	Slope Drain				X				
TDS	Temporary Drains or Swales	X		X	X		X		
TSC	Temporary Stream Crossing					X			
	Velocity Reduction								
OP	Outlet Protection					X			
SR	Surface Roughening			X					
	Trap/Filter Sediment								
BRF	Brush or Rock Filter		X		X	X		X	
FSC	Flotation Silt Curtain					X			
IP	Inlet Protection - Excavated	X							
IP	Inlet Protection - Gravel	X							
IP	Inlet Protection - Concrete Block	X							
IP	Inlet Protection - Silt Fence or Straw B	X							
SBB	Sand Bag Barrier		X			X		X	
SB	Sediment Basin	X							
ST	Sediment Trap	X				X			
SF	Silt Fence		X		X	X		X	
STB	Straw Bale Barrier		X		X	X		X	

Commercial and Industrial BMPs

		BMP Criteria							
Source Control BMPs to Consider		Manufacturing	Material Handling	Vehicle Maintenance	Construction	Commercial Activities	Roadways	Waste Containment	Housekeeping Practices
ACP	Area Control Procedures	X				X			X
ATL	Aboveground Tank Leak and Spill Control	X	X			X	X	X	
BGM	Buildings and Grounds Maintenance					X	X		X
BRRC	Building Repair, Remodeling and Construction				X	X			X
CD	Containment Dikes	X						X	
CESA	Contaminated or Erodible Surface Areas				X		X		
CO	Covering	X	X	X	X	X		X	X
CU	Curbing	X	X		X	X		X	X
DCUS	De-Icing Chemical Use and Storage		X				X	X	X
DP	Drip Pans	X						X	
ET	Employee Training	X	X	X	X	X	X	X	X
HWM	Hazardous Waste Management	X	X	X	X			X	X
NSWD	Non-Storm Water Discharges to Drains	X		X		X		X	X
OCSL	Outdoor Container Storage of Liquids		X		X	X		X	X
OLUM	Outdoor Loading/Unloading of Materials		X		X	X			X
OPE	Outdoor Process Equipment Operations	X		X	X	X			X
OSRM	Outdoor Storage of Raw Materials	X	X		X	X			X
SL	Signs and Labels	X				X			X
VEC	Vehicle and Equipment Cleaning			X	X	X			X
VEF	Vehicle and Equipment Fueling		X	X	X	X			X
VEMR	Vehicle and Equipment Maintenance & Repair		X	X	X	X			X
WHD	Waste Handling and Disposal		X		X	X		X	X

		BMP Criteria						
Treatment Control BMPs to Consider		Soils	Area Required	Slope	Water Availability	Aesthetics	Hydraulic Head	Environmental Side Effects
BF	Biofilters	X	X	X	X			
CW	Constructed Wetlands	X	X	X	X	X		X
DCIA	Minimizing DCIAs			X		X		
DTSF	Double Trench Sand Filter	X		X				
EDB	Extended Detention Basins		X			X	X	
GA	Gelling Agents							X
IN	Infiltration	X	X	X		X		X
LS	Level Spreaders	X	X	X		X		X
MF	Media Filtration						X	
OWS	Oil/Water Separators and Water Quality		X					
PSF	Peat-Sand Filter System	X		X				
SO	Sorbents							X
SSFS	Surface Sand Filter System	X		X			X	
SU	Sumps						X	
TSF	Trench Sand Filter System	X		X				
WP	Wet Ponds		X	X	X	X		X

Municipal BMPs

		Program Elements			
Source Control BMPs to Consider		New Development	Residential	Commercial Activities	Industrial Activities
ATL	Aboveground Tank Leak and Spill Control			X	X
BGM	Buildings and Grounds Maintenance			X	X
BRRC	Building Repair, Remodeling, and Construction			X	X
CBC	Catch Basin Cleaning				
CESA	Contaminated or Erodible Surface Areas	X		X	X
DIDM	Detention/Infiltration Device Maintenance				
ET	Employee Training	X	X	X	X
HWM	Hazardous Waste Management	X	X	X	X
HP	Housekeeping Practices		X		
IDC	Illegal Dumping Controls				
LUPM	Land Use Planning/Management	X			
LSSC	Leaking Sanitary Sewer Control		X	X	X
LC	Litter Control	X	X	X	X
PEP	Public Education/Participation		X	X	
RBM	Roadway/Bridge Maintenance				
SCCM	Storm Channel/Creek Maintenance	X			
SDF	Storm Drain Flushing				
SDSS	Storm Drain System Signs	X	X	X	X
SC	Street Cleaning				
VUR	Vehicle Use Reduction	X	X		

		BMP Criteria			
Treatment Control BMPs to Consider		Soils	Area Required	Slope	Water Availability
BF	Biofilters	X	X	X	X
CM	Chemical Mulch	X		X	
CW	Constructed Wetlands	X	X	X	X
DTSF	Double Trench Sand Filter	X		X	
EDB	Extended Detention Basins		X		
FS	Floatable Skimmers				X
IN	Infiltration	X	X	X	
LS	Level Spreaders	X	X	X	
MF	Media Filtration				
DCIA	Minimizing DCIAs			X	
OWS	Oil/Water Separators and Water Quality Inlets		X		
PSFS	Peat-Sand Filter System	X		X	
RR	Riprap	X	X	X	
SSFS	Surface Sand Filter System	X		X	
TSFS	Trench Sand Filter System	X		X	
WP	Wet Ponds	X	X	X	X

WEST VALLEY CITY PUBLIC WORKS DEPARTMENT
3600 South Constitution Blvd.
West Valley City, Utah 84119
www.ci.west-valley.ut.us

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GUIDANCE DOCUMENT FOR STORMWATER MANAGEMENT

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CHAPTER 1

INTRODUCTION

Water flowing over the land during and immediately following a rainstorm is called stormwater runoff. Stormwater runoff from urban areas is collected and concentrated into storm drain systems and conveyed to canals, creeks, river, and eventually to the Great Salt Lake.

Stormwater runoff is part of a natural hydrologic process. However, human activities can greatly affect the quality and quantity of stormwater runoff. When vegetation is removed and roadways and buildings are constructed, pollutants are more easily washed into gutters and storm drain systems which discharge to receiving waters. Consequently, improperly managed stormwater runoff can be a significant source of water pollution, causing declines in fisheries, habitat disruption, restrictions of swimming, and limiting our ability to enjoy many of the other benefits that water provides.

PURPOSE AND SCOPE OF THE GUIDANCE DOCUMENT

In order to reduce stormwater pollution, Best Management Practices are employed. Best Management Practices (BMPs) are the activities, practices, and procedures designed to prevent or reduce the pollution of rivers, creeks, and lakes. The purpose of this document is to provide guidance for selecting and implementing best management practices for construction, public, municipal, and industrial activities. **This document is not intended to dictate the BMPs to be implemented, rather to provide a framework for BMP selection.**

ORGANIZATION OF THE GUIDANCE DOCUMENT

The overall purpose of the stormwater program is to reduce stormwater pollution to receiving waters. This guidance document is organized to assist the user in developing and implementing such a program.

This guidance document is divided into six chapters. Each chapter may be utilized independently of the rest of the document. The chapters are organized as follows:

The need for stormwater management (Chapter 1)

The impacts of stormwater pollution and Best Management Practices associated with:

- Construction Activities (Chapter 2);
- Public Activities (Chapter 3);
- Municipal Activities (Chapter 4);
- Industrial Activities (Chapter 5); and
- How to prepare a SWPPP (Stormwater Pollution Protection Plan) for construction/industrial activities (Chapter 6).

STORMWATER REGULATIONS

The need to protect our environment has resulted in a number of laws and subsequent regulations and programs. The Federal Clean Water Act is the regulation which controls stormwater pollution. There are, however, other regulations that directly or indirectly deal with the stormwater. In addition, stormwater programs are in place at a number of levels: federal, state, and local.

National Pollutant Discharge Elimination System (NPDES) programs on both the Federal and State levels are discussed below in relationship to the control of stormwater pollution. Other regulations may need to be considered on a case-by-case basis; however, the user is advised to contact local regulatory officials for further information.

National Pollutant Discharge Elimination System (NPDES). In 1972, the Federal Clean Water Act was amended to prohibit any point source discharge of pollutants to waters of the United States, unless the discharge is in compliance with a NPDES

permit. In 1990, the U.S. Environmental Protection Agency (USEPA) published final regulations establishing application requirements for stormwater discharge permits for specific categories of industries and municipalities.

Utah Pollutant Discharge Elimination System (UPDES). In Utah, the Division of Water Quality administers the NPDES program, issuing UPDES permits for stormwater discharges into receiving waters. The permit requires a Stormwater Pollution Prevention Plan (SWPPP) which applies specific Best Management Practices (BMPs) on a site-by-site basis to reduce stormwater pollution.

Flood Control Permit. For discharges to creeks, rivers and West Valley City/Salt Lake County flood control systems, a Flood Control Permit is required. The permit application requires design drawings and storm flows which discharge into the system.

Municipal Permits. Stormwater discharges are permitted through the municipality in which the flows discharge. Permits and approvals are generally required prior to construction.

TYPICAL POLLUTANTS FOUND IN STORMWATER

Construction, public, municipal, and industrial activities produce a variety of different kinds of pollutants which may cause stormwater contamination. A general discussion of typical stormwater pollutants is found below. Pollutants of concern for construction, public, municipal, and industrial activities are found in subsequent chapters.

Sediment

Sediment carried by stormwater into streams, lakes, rivers, and wetlands can affect aquatic life and habitat. Suspended soil particles can cause water to look murky or cloudy. Excessive sediment reduces light penetration in water, impairs sight feeding fish, clogs fish gills, and increases drinking water treatment costs. Fine sediment also acts as a transport for pollutants including nutrients, metals, and hydrocarbons to enter surface waters.

Nutrients

Nutrients, mostly nitrogen and phosphorus, are essential to the growth of plants and aquatic organisms. However, too many nutrients in water bodies may cause algae growth, odor problems and deterioration of the aesthetic aspects of the water body.

Ammonium, a form of nitrogen, can also have severe effects on water quality. Ammonium is converted to nitrate and nitrite in a process called nitrification. This process consumes large amounts of oxygen and can kill fish by lowering the oxygen levels in water. These conditions can impair many important uses of these waters, including recreation and fish habitat.

Metals

Metals, such as nickel, manganese, lead, chromium, cadmium, zinc, copper, iron, and mercury are toxic to aquatic life in excessive quantities. Metals are found in sediments in streams and creeks. Metals can also be a health hazard to humans through direct ingestion of contaminated water or through eating contaminated fish.

Oxygen-demanding substances

While land animals extract oxygen from the air, aquatic life depends on oxygen dissolved in water. When organic matter is eaten by microorganisms, dissolved oxygen of the water is consumed. After it rains, stormwater runoff can deposit large quantities of oxygen-demanding substance in creeks or streams. This can create a pulse of high oxygen demand that can deplete oxygen supplies in shallow, slow moving, or poorly flushed waters. Oxygen depletion is a common cause of fish kills.

Bacteria and Viruses

Bacteria and viruses are the most common microorganisms found in stormwater runoff, their levels are highest in the summer. Bacteria and viruses often carry diseases which can be transferred to animal life and to humans. Recreational uses of streams and creeks are limited in areas with high levels of microorganisms.

Oil and grease

Oil and grease includes many hydrocarbon compounds some of which are toxic to aquatic organisms at low concentrations.

Floatables

Floatables are pieces of litter, trash or garbage which are transported into water during storm events. Litter is also commonly disposed of directly into storm drain catch basins. Floatables also create aesthetic problems and impact the operating effectiveness of drainage systems.

STORMWATER MANAGEMENT

For many years the effort to control stormwater focused on flooding issues and removing water from urban areas. Stormwater was generally permitted through flood control programs. In recent years regulatory programs have been established to reduce all pollution sources entering water ways. Programs have been established for point source and non-point source discharges. An emphasis of these programs is to contain pollution at the source, before it can cause environmental problems. It has been demonstrated that keeping pollutants out of water is more cost-effective than removing the pollutants once they are in the stormwater. However, if additional controls are needed, treatment of contaminated runoff could be required.

Stormwater management is the shift in emphasis toward comprehensive prevention orientated strategies. One of these strategies is the implementation of the Best Management Practices (BMPs). Comprehensive site management should include:

- surface drainage;
- flood control;
- erosion and sediment control; and
- reduction of pollutants in runoff.

This guidance document focuses on site controls which are designed to keep pollutants from entering storm drain systems and receiving waters. Both reducing the source of contamination, revegetation to keep soil on-site and diverting stormwater around the site to prevent contamination are examples of site controls. These controls and practices are called source controls and focus on prevention of pollutant introduction into stormwater runoff, or stopping the pollutant at the source, prior to reaching the drainage system or receiving waters. It is more efficient and cost-effective to prevent water quality problems than to treat the water to eliminate the pollutants after the fact.

Watershed planning is also an element in the broader comprehensive approach. This involves evaluating appropriate controls and locations of the controls to reduce pollution from all sources within a watershed or regional area. Watershed planning is not discussed in this document.

STORMWATER MANAGEMENT STRATEGIES

With so many controls available, a general strategy is helpful for determining which BMPs to implement first. The strategies below are listed in order of preference and cost effectiveness.

Alter the activities. The most preferred and least costly BMPs are those that alter the activity to prevent pollution from either being produced or from leaving the site.

Enclose the activities. Enclosing an activity in a building is beneficial for two main reasons: 1) precipitation is prevented from coming into contact with the activity; and 2) drains inside of a building must discharge to a sanitary sewer system.

Cover the activities. If the activity cannot be placed inside a building, covering the area will prevent most precipitation from coming into contact with the activity and/or materials.

Separate the activities. Separate the activity that is the most significant source of pollutants from other activities that either cause little or no pollution. By separating the activities, one of the above strategies may be possible for one or more of the activities.

Treat the Stormwater. Treatment of the stormwater is the least preferred option because stormwater treatment devices are extremely expensive and generally not practicable. Most treatment systems are designed to constant flow streams with consistent or known levels of pollutants to be removed. This is not the case with most stormwater discharges.

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CHAPTER 2

STORMWATER DISCHARGE MANAGEMENT FROM CONSTRUCTION ACTIVITIES

Pollutants of Concern
Selection of Best Management Practices
References
BMP Information Sheets

Stormwater runoff becomes polluted by picking up soil particles and other pollutants (from construction materials) as it flows over surfaces where construction activities are occurring. The polluted stormwater is eventually deposited into rivers, streams, and lakes, where it may be harmful to plants and aquatic life. This guidance document will address the impacts and origins of these potential pollutants and explain various methods to reduce pollutant discharge into stormwater systems.

The primary users of this guidance document will be property owners, developers, contractors, engineers, and public agencies who are involved in construction and land disturbance activities. Municipal departments that oversee these activities will also find this guidance document useful.

POLLUTANTS OF CONCERN

Sediment in stormwater is the primary pollutant of concern for construction activities. Other pollutants including heavy metals, nutrients, and additional toxics (construction materials and chemicals) are often found in runoff waters from construction sites. The following sections address stormwater runoff from the pollutants of concern associated with construction site activities along with impacts to receiving waters caused by these pollutants.

Sediment

Soil erosion is the process by which soil particles are removed from the land surface by wind, water, or gravity. Water erosion is the primary mechanism for the transport of sediment into stormwater systems and receiving waters. Vegetation protects soil from erosion by intercepting and absorbing rainfall, and by binding soil together with root structures. When trees and brush are removed, soil is exposed and is easily transported off site, resulting in increased sediment migration. Natural depressions and hills which temporarily pond water are often removed by grading activities; rainfall then runs off the area, taking with it soil particles. Runoff from areas which have been cleared and grubbed are associated with generally higher volumes of flow conveyed at an increased velocity capable of carrying sediment particles.

Excessive sediment in water can cause increased turbidity and reduced light penetration, resulting in impaired vision for aquatic life, clogging of fish gills, and a reduction in aesthetic values. In addition, other substances such as nutrients, heavy metals, and hydrocarbons tend to attach to sediment and in turn are transported with the sediment.

Nutrients

Nutrients, nitrogen and phosphorus, from fertilizers, pesticides, construction chemicals, and solid waste are often generated at construction sites. Excessive discharge into waterways may result in algae growth which can cause odor problems and reduce the dissolved oxygen available to fish and other aquatic life.

Oils and Greases

Oil and grease contain a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. The main sources of oil and grease during construction activities are leakage from engines, spills at fueling stations, overfilled tanks, and waste oil disposal.

Other Toxic Chemicals

Construction of buildings and roads may require toxic or hazardous materials such as pesticides, herbicides, petroleum products, and building materials such as asphalt, sealants and concrete which may pollute stormwater running off the construction site. These types of pollutants often contain small amounts of metals and other toxic

materials which may be harmful to humans, plants, and fish in streams.

Miscellaneous Wastes

Miscellaneous wastes include wash water from concrete mixers, paints and painting equipment cleaning activities, solid wastes resulting from trees and shrubs removed during land clearing, wood and paper materials derived from packaging of building products, food containers such as paper, aluminum, and metal cans, and sanitary wastes. The discharge of these can lead to unsightly and polluted waterways.

Several typical construction site products and pollutants are shown in Table 2-1.

Table 2-1. CONSTRUCTION SITE POLLUTANTS

CATEGORY	PRODUCT	POLLUTANTS
Adhesives	Adhesives, Glues	Formaldehydes
	Resins, Epoxy synthetics,	Formaldehydes
	Caulks, Sealers, Putty, Sealing Agents	Asbestos, Phenolics, Formaldehydes
	Coal Tars (Naphtha, Pitch)	Benzene, Phenols, Naphthalene
Cleaners	Polishes (Metal, Ceramic, Tile)	Metals
	Etching Agents	Metals
	Cleaners, Ammonia, Lye, Caustic Sodas	Acidity/Alkalinity
	Bleaching Agents	Acidity/Alkalinity
	Chromate Salts	Chromium
Plumbing	Solder (Lead, Tin), Flux (Zinc Chloride)	Lead, Copper, Zinc, Tin
	Pipe Fitting (Cut Shavings)	Copper
	Galvanized Metals (Nails, Fences)	Zinc
	Electric Wiring	Copper, Lead
Painting	Paint Thinner, Acetone, MEK, Stripper	VOCs
	Paints, Lacquers, Varnish, Enamels	Metals, Phenolics, Mineral Spirits
	Turpentine, Gum Spirit, Solvents	VOCs
	Sanding, Stripping	Metals
	Paints (Pigments), Dyes	Metals
Woods	Sawdust	BOD
	Particle Board Dusts (Formaldehyde)	Formaldehyde
	Treated Woods	Copper, Creosote
Masonry & Concrete	Dusts (Brick, Cement)	Acidity, Sediments
	Colored Chalks (Pigments)	Metals
	Concrete Curing Compounds	
	Glazing Compounds	Asbestos
	Cleaning Surfaces	Acidity
Floors & Walls	Flashing	Copper, Aluminum
	Drywall	Dusts
	Tile Cutting (Ceramic Dusts)	Minerals
	Adhesives*	
Remodeling & Demolition	Insulation	Asbestos
	Venting Systems	Aluminum, Zinc
	Brick, Cement, Saw, Drywall	Dusts
Air Conditioning & Heating	Insulating	Asbestos
	Coolant Reservoirs	Freon
	Adhesives*	
Yard O&M	Vehicle and Machinery Maintenance	Oils and Grease, Coolants
	Gasoline, Oils, Additives	Benzen & Derivatives, Oils & Grease
	Marking Paints (Sprays)	Vinyle Chloride, Metals
	Grading, Earth Moving	Erosion (Sediments)
	Portable Toilets	BOD, Disinfectants (Spills)
	Fire Hazard Control (Herbicides)	Sodium Arsenite, Dinitro Compounds
	Health and Safety	Rodenticides, Insecticides
	Wash Waters (Herbicides, Concrete, Oils, Greases)	
Landscaping & Earthmoving	Planting, Plant Maintenance	Pesticides, Herbicides, Nutrients
	Excavation, Tilling	Erosion (Sediments)
	Masonry & Concrete*	
	Solid Wastes (Trees, Shrubs)	BOD
	Exposing Natural Lime or Other Mineral Deposits	Acidity/Alkalinity, Metals
	Soils Additives	Aluminum Sulfate, Sulfur
	Revegetation of Graded Areas	Fertilizers
Materials Storage	Waste Storage (Used Oils, Solvents, etc.)	Spills, Leaks, Polluted Discharge
	Hazardous Waste Containment	Spills, Leaks, Polluted Discharge
	Raw Material Piles	Dusts, Sediments, Polluted Discharge

*See above categories

Note: VOC = Volatile Organic Compounds, BOD = Biochemical Oxygen Demand due to the use of oxygen of microorganisms decomposing materials.

BEST MANAGEMENT PRACTICES

Implementation and maintenance of Best Management Practices (BMPs) for erosion and sediment control during construction activities is critical for stormwater quality management. The purpose of MPs is to limit the amount and rate of erosion and to capture the transported sediment before it has the opportunity to enter a stormwater collection system or water course. The four major areas of BMP implementation for construction activities are erosion controls, sediment controls, waterway protection, and material storage management. Specific BMPs are found at the end of this chapter.

EROSION CONTROLS

Erosion controls are used to limit erosion of disturbed areas by restricting stormwater runoff across the area or by using temporary stabilization methods.

Erosion controls employed in and around disturbed areas are designed to:

- prevent stormwater runoff reaching open disturbed areas;
- reduce velocities and volumes of runoff on open areas; and
- stabilize the soil surface.

Controls to divert runoff away from disturbed areas should be in place prior to commencement of construction activities. Controls to be placed within disturbed areas should be constructed when work in the area has temporarily ceased.

Surface stabilization should be applied to areas that will remain undisturbed for longer than 14 days and should be implemented as soon as possible after activities have ceased.

Erosion controls often overlap sediment controls, since diversion of runoff to prevent down gradient erosion also provides sediment control by diverting sediment-laden flows to controlled discharge points.

SEDIMENT CONTROLS

Sedimentation controls are used to filter runoff from disturbed areas and to trap sediment in a controlled area prior to leaving the site.

Sediment controls employed to trap sediment and filter stormwater runoff from disturbed areas include:

- sediment barriers,
- sediment traps, and
- protection of storm drainage facilities.

Construction of sediment controls should take place prior to onstruction activities; they should be regularly inspected and maintained throughout the construction period. Removal of controls and reclamation of the area disturbed for placement of controls should take place when up gradient areas have achieved final cover.

WATERWAY PROTECTION

Waterway protection is used to protect drainage paths, stormwater collection systems and natural water courses from erosion and sedimentation.

Erosion and sediment controls should be constructed upgradient of waterways prior to construction activities and maintained throughout the project. Waterways should be protected not only from increased sediment but also from high velocity or volume of runoff which may erode channels and banks. For small volumes of runoff where flows are not concentrated, a sediment barrier (e.g., straw bale barrier, silt fence) or diversion dike can be constructed paralleling the

top of bank to filter runoff and trap sediment before flows reach the waterway or to divert flows away from the waterway. For concentrated flow, energy dissipation and sediment traps or basins are required before discharge to the waterway in order to reduce eroding velocity of flows and prevent sedimentation. A sediment basin may be required to act as a detention basin and control peak volumes of runoff if the increased volumes will impact the waterway.

No construction or placement of controls should occur within the banks or channel of a running water course without approval of the Utah Division of Water Rights. Vegetation around waterways should also be protected, since impact to vegetation will ultimately impact the waterway, a sufficient buffer should be established and remain untouched.

If a permanent discharge is proposed, some means of permanent protection should be installed, such as rip-rap outlet protection with permanent sediment trap up gradient. Non-stormwater discharges to waterways or existing stormwater systems are prohibited, with a few exception as specified in the UPDES general permit.

Where work is required within a waterway, local, state and federal requirements may govern. The following BMPs generally should be observed:

- keep construction vehicles out of the waterway to the extent possible;
- keep duration of activity to a minimum;
- temporarily dam or divert flows when appropriate;
- remove any sediment or construction debris immediately on completion of activity;
- restore waterway to original course and complete stabilization of banks and channel immediately following associated activity;
- stabilize adjacent areas and construct temporary silt barriers as necessary.

MATERIAL STORAGE MANAGEMENT

Material storage management involves proper handling, storage, and disposal of all materials which are potential contaminates to water supplies.

Other on-site controls are required for materials introduced to the site for construction purposes, to protect stormwater runoff from contamination. Materials such as fuel, oil, lubricants, paints, solvents, concrete-curing compounds, fertilizers, pesticides, and herbicides are a threat to water quality. Controls which address the storage, handling, and disposal of these materials are discussed below.

Storage

Toxic materials should be stored in a designated location with berm or other perimeter control to contain potential spills. On an unsecured site, toxic materials should be contained in a locked enclosure for limited access.

Where storage at the central location is impractical, materials used on a daily basis should be stored within structures or in vehicles where they will not be exposed to rainfall and therefore, have little chance of contaminating runoff. Materials should be stored in their original containers with clearly marked labels showing material, handling, and use specifications, primary constituents, and warnings. Only materials anticipated for use in project activities should be stored on-site.

Handling

All materials should be handled according to manufacturers' instructions. Precautions should be taken to avoid spills. In the event of a spill, containment by sandbags, earth berms, or other means should be employed immediately. The spilled material should then be collected and disposed of properly and the area remediated by removal and proper disposal of contaminated dirt.

Any structures such as pavement, concrete, culverts or storm drain inlets exposed to the spill should be examined and remediated as necessary. Proper documentation of the spill and notification of appropriate agencies should be performed in accordance with local, state, and federal requirements.

Disposal

No on-site burning of material, surface disposal, or burial of material should be allowed. All non-toxic waste material should be placed in a covered storage area or dumpster for prompt removal to disposal site. Toxic materials should be disposed of properly at an approved facility. Storage locations for waste materials should be located away from storm drainage systems.

BMP SELECTION

The selection of BMPs is site-specific with regard to activity, topography, soil conditions, and stormwater facilities. The selection is generally a three step process as shown below. Refer to "Use of BMP Information Sheets" at the end of this section for specific selection information.

Define BMP Objectives: Define locations where erosion is likely to occur and where other construction related pollutants may be generated.

Identify the BMP Category: Select the appropriate category or categories of BMPs which address each objective.

Select the appropriate BMPs: BMPs are often selected from each category based on site constraints, construction requirements, and cost-effectiveness considerations.

DEFINE BMP OBJECTIVES

Each construction project is unique. Therefore, an understanding of the pollution risks of the construction activity is essential for selecting and implementing BMPs. Once the pollution risks are defined, BMP objectives are developed and the BMPs are selected. Examples of the BMP objectives for construction projects are:

Practice Good Housekeeping: Conduct activities in a manner which keeps potential pollutants from either draining or being transported off-site.

Contain Waste: Dispose of all construction waste in designated areas and keep stormwater from flowing on to or off of these areas.

Minimize Disturbed Areas: Only clear land which is actively under construction in the near term (e.g., within the next 6-12 months), minimize new land disturbance during the rainy season, and avoid clearing/disturbing sensitive areas (e.g., steep slopes and natural watercourses) and other areas where site improvements will not be constructed.

Stabilize Disturbed Areas: Provide temporary stabilization of disturbed soils whenever active construction is not occurring on a portion of the site. Provide permanent stabilization during finish grade and landscape the site.

Protect Slopes and Channels: Outside of approved grading plan area, avoid disturbing steep or unstable slopes. Safely convey runoff from the top of the slope, and stabilize slopes as quickly as possible. Avoid disturbing natural channels. Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in runoff velocity caused by the project do not erode the channel.

Control Site Perimeter: Upstream runoff should be diverted around or safely conveyed through the construction project. Local codes usually state that such diversions must not cause downstream property damage or be diverted into another watershed. Runoff from the project site should be

free of excessive sediment and other constituents.

Control Internal Erosion: Detain sediment-laden waters from disturbed, active areas within the site.

IDENTIFY BMP CATEGORIES

Once the BMP objectives are defined, it is necessary to identify the category of BMPs that is best suited to meet each objective. A category is a grouping of BMPs which are related in how they control stormwater pollution (see Table 2-2). The particular BMP selected from each category depends on the specific site conditions, construction activities, and cost-effectiveness considerations.

To determine where to implement categories of BMPs, a map of the project site is prepared with sufficient topographic detail to show existing and proposed drainage patterns and existing and proposed stormwater control structures. The project site map should identify the following:

- Locations where stormwater enters and exits the site;
- Locations of permanent stormwater collection and control systems;
- Locations subject to high rates of erosion such as steep slopes or unlined channels;
- Locations of sensitive areas which must not be disturbed. Establish clearing limits around these areas to prevent disturbance by the construction activity;
- Locations of the boundaries of drainage areas if the site has more than one drainage outlet. Calculate the approximate area of each drainage area;
- Define areas where various contractor activities have a likely risk of causing a pollutant discharge.

Once identified on the site map, the categories of BMPs can be selected and located. In general, source control BMPs should be utilized wherever possible because it is better to ***prevent*** erosion and pollution than to ***remove*** sediments and pollutants.

SELECT APPROPRIATE BMPS

As shown in Table 2-2, many BMPs achieve more than one BMP objective. This should be taken into consideration when selecting BMPs to achieve maximum cost-effectiveness. Not all BMPs will apply to every site, however; all BMPs should be considered for each site. Different BMPs may be needed for different phases of the construction project. Thus, the Stormwater Pollution Prevention Plan may include a set of BMPs suitable for different stages of the project.

MONITORING BMP PERFORMANCE

Once the BMPs have been selected and implemented, it is important to routinely monitor how well the BMPs work and to evaluate whether additional BMPs are required.

For more information on BMP selection and monitoring, the reader is advised to refer to Chapter 6 - "How to prepare a SWPPP for construction activities".

REGULATORY PERMITS

Stormwater discharges and storm drainage systems are regulated and permitted by various agencies. These agencies control design of systems, discharge quantities and locations and other aspects of stormwater runoff. Below is a brief description of permits and regulations which apply to stormwater discharges.

Stormwater discharges from construction activities. A Utah Pollutant Discharge Elimination System (UPDES) Permit is required from the Utah Division of Water Quality.

Stormwater discharges to Salt Lake County Flood Control System. Prior to construction of a stormwater drainage system, approval of a Salt Lake County Flood Control permit is required from Salt Lake County Engineering Division.

Outfalls into Waters of the U.S. For system outfalls which discharge stormwater into waters of the U.S., a stream alteration/404 joint permit may be required from the Utah State Engineer's Office.

Local Municipalities Approval. Site drainage is approved at the local level by the municipality who maintains jurisdiction over the site. Generally, drainage design, system and discharge requirements are approved prior to construction.

Table 2-2. BMP Selection and Implementation

BMP Category	BMP Objectives						
	Practice Good Housekeeping	**Contain Waste**	**Minimize Disturbed Areas**	**Stabilize Disturbed Areas**	**Protect Slope & Channels**	**Control Site Perimeter**	**Control Internal Erosion**
BMPs for Contractor Activities							
Construction Practices	**U**			**U**	**U**	**U**	**U**
Material Management	**U**						
Waste Management		**U**	**U**	**U**			
Vehicle & Equipment Management	**U**					**U**	**U**
Contractor Training	**U**	**U**					
BMPs for Erosion & Sediment Control							
Site Planning Considerations	**U**	**U**	**U**	**U**	**U**	**U**	**U**
Vegetative Stabilization				**U**	**U**		
Physical Stabilization	**U**		**U**	**U**	**U**	**U**	
Diversion of Runoff		**U**			**U**	**U**	**U**
Velocity Reduction				**U**	**U**		
Sediment Trapping / Filtering					**U**	**U**	**U**

REFERENCES

Berman, L., C. Hartline, N. Ryan, and J. Thorne. 1991. "Urban Runoff: Water Quality Solutions." American Public Works Association, Special Report #61.

City of Boise, Public Works Department. January 1997. "Boise Storm Water Best Management Practices (BMP) Guidebook."

Denver Regional Council of Governments. February 1998. "Keeping Soil On Site - Construction Best Management Practices."

State of California. March 1993. "California Storm Water Best Management Practice Handbooks."

State of Minnesota. October 1989. "Protecting Water Quality in Urban Areas - Best Management Practices for Minnesota."

U.S. Environmental Protection Agency. September 1992. "Storm Water Management for Construction Activities - Developing Pollution Prevention Plans and Best Management Practices," EPA-832-R-92-005.

USE OF BEST MANAGEMENT PRACTICE (BMP) INFORMATION SHEETS

The BMP Information Sheets attached are compiled from research and review of existing documents. These BMPs are presented as accepted practices currently in use nationwide. Variations from BMPs described herein will be acceptable, provided implemented controls meet the intent of Best Management Practices for controlling pollution during construction activities.

Each information sheet is organized into three main sections:

- Heading
- Main Body
- Side Bar

HEADING

In addition to the title of the BMP, a 2 to 4 letter abbreviation of the BMP is provided in the upper right-hand corner. The abbreviation may be used for identifying the selected BMP on the Storm Water Pollution Prevention Plan (SWPPP) Site Map. The information sheet for the selected BMP can then be attached to the SWPPP to provide details regarding purpose, installation, and maintenance.

MAIN BODY

The main body in each BMP sheet contains the following information:

- Example illustration of the BMP;
- description of the BMP;
- applications;
- installation/application criteria;
- maintenance; and
- limitations.

SIDE BAR

The side bar identifies the objectives of the BMP, pollutants targeted by the BMP, and an indication of the level of effort and costs to implement.

Objectives:
Housekeeping Practices
Contain Waste
Minimize Disturbed Areas
Stabilize Disturbed Areas
Protect Slopes/Channels
Control Site Perimeter
Control Internal Erosion

Targeted Pollutants:
Sediment
Nutrients
Toxic Materials
Oil & Grease
Floatable Materials
Other Waste

Each information sheet provides an indication of whether the BMP will have a high, medium, or low/unknown impact on removing these constituents.

Implementation Requirements:
Costs:
    Capital Costs
    O&M Costs
Level of effort associated with:
    Maintenance
    Training

Each information sheet indicates the relative cost or level of effort (high, medium, low) to implement the BMP.

DECISION MATRIX

The BMPs for construction activities are listed in the decision matrix on the following page. The matrix is provided to give the user a relatively easy way to identify applicable BMPs. The user should understand that the matrix is only a guide and should not be used in place of sound engineering judgement.

To use the matrix, identify the BMP criteria (going horizontally across the top of the sheet) that apply to the construction activity. Once identified, select the BMPs (running vertically along the left side of the sheet) which match these criteria.

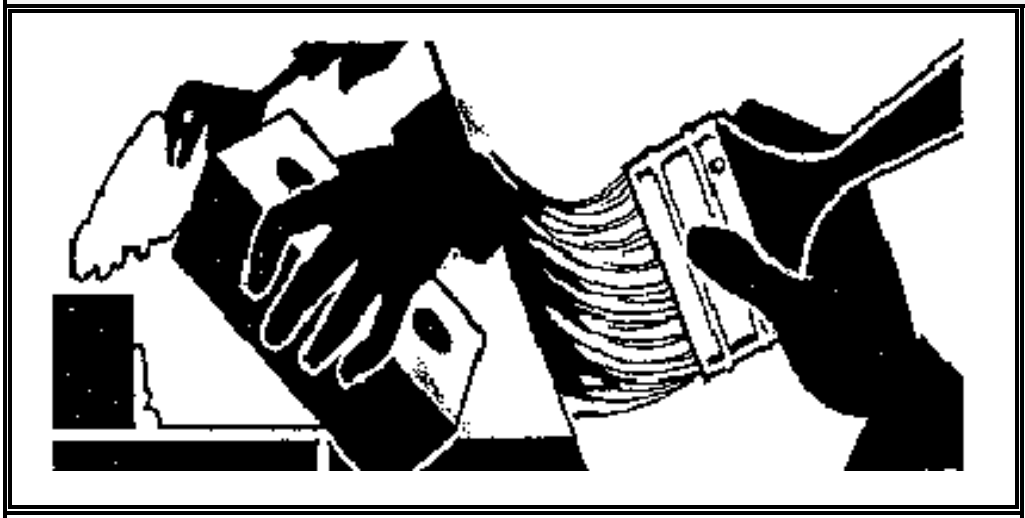
Construction BMPs

Storm Water Utility

	BMPs to Consider	BMP Criteria							
		General- for all Sites	Hazardous Wastes Used?	Excavation on Flat Surfaces?	Excavation on Slopes?	Water Bodies on Site?	Construction Temporarily Stopped?	Outside Storage Piles?	Post-Constructi on BMPs
	Waste and Material Management								
BRRC	Building, Repair, Remodeling, and Construction	X	X						
CWM	Concrete Waste Management	X	X			X			
EBB	Earth Berm Barrier		X	X	X			X	
HWM	Hazardous Waste Management	X	X						
MS	Material Storage	X	X					X	
MU	Material Use	X	X						X
PT	Portable Toilet	X							
SCU	Spill Clean-Up		X					X	X
WD	Waste Disposal	X	X					X	
	Vehicle and Equipment Management								
EVWA	Equipment and Vehicle Washdown Ar	X							
VEC	Vehicle and Equipment Cleaning	X							
VEF	Vehicle and Equipment Fueling	X							
	Stabilization								
BIO	Bioengineering				X	X			X
CM	Chemical Mulch				X		X		
CP	Compaction	X		X					
CR	Construction Road Stabilization	X		X	X				
CES	Contaminated or Erodible Surface Are			X	X				
DC	Dust Controls	X		X	X			X	
ECB	Erosion Control Blankets			X	X		X		X
FS	Filter Strips	X				X			X
GM	Geotextiles and Mats				X	X	X		X
HM	Hydromulching			X	X				X
MU	Mulching			X			X		X
PEV	Preservation of Existing Vegetation	X			X	X			X
SP	Seeding and Planting			X	X		X		X
SCE	Stabilized Construction Entrance	X							
TPS	Temporary and Permanent Seeding			X			X		X
	Runoff Diversion								
BE	Benching				X			X	
CD	Check Dams				X	X			
DD	Diversion Dike	X			X	X		X	
SD	Slope Drain				X				
TDS	Temporary Drains or Swales	X		X	X		X		
TSC	Temporary Stream Crossing					X			
	Velocity Reduction								
OP	Outlet Protection					X			
SR	Surface Roughening			X					
	Trap/Filter Sediment								
BRF	Brush or Rock Filter		X		X	X		X	
FSC	Flotation Silt Curtain					X			
IP	Inlet Protection - Excavated	X							
IP	Inlet Protection - Gravel	X							
IP	Inlet Protection - Concrete Block	X							
IP	Inlet Protection - Silt Fence or Straw B	X							
SBB	Sand Bag Barrier		X			X		X	
SB	Sediment Basin	X							
ST	Sediment Trap	X				X			
SF	Silt Fence		X		X	X		X	
STB	Straw Bale Barrier		X		X	X		X	

BMP: Building Repair, Remodeling, and Construction

BRRC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from building repair, remodeling and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

APPLICATION:

< Use soil erosion control techniques if bare ground is temporarily exposed.
< Use permanent soil erosion control techniques if the remodeling clears buildings from an area that are not to be replaced.

INSTALLATION/APPLICATION CRITERIA:

< Enclose painting operations consistent with local air quality regulations and OSHA.
< Properly store materials that are normally used in repair and remodeling such as paints and solvents.
< Properly store and dispose waste materials generated from the activity.
< Maintain good housekeeping practices while work is underway.

LIMITATIONS:

< This BMP is for minor construction only.
< Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.
< Safer alternative products may not be available, suitable, or effective in every case.
< Be certain that actions to help storm water quality are consistent with OSHA and air quality regulations.

MAINTENANCE:

None.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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West Valley City Engineering Division
3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

ENGINEERING DIVISION
MANAGING THE FUTURE

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Stormwater Management Plan Review: 801-963-3318
Stormwater Permit: 801-963-3318

TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

Sediment
9 Nutrients
■ Toxic Materials
■ Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

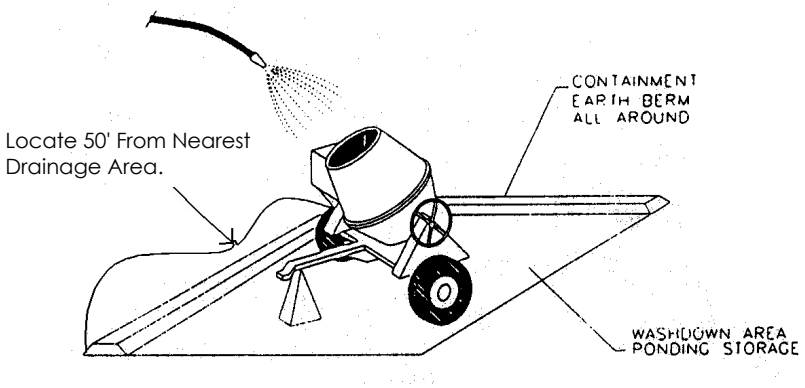
9 Capital Costs
: O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adapted From Salt Lake County Engineering Division Guidance Document

BMP: Concrete Waste Management

CWM



DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from concrete waste by conducting washout off-site, performing on-site washout in a designated area, and training employees and subcontractors.

APPLICATIONS:

This technique is applicable to all types of sites.

INSTALLATION/APPLICATION CRITERIA:

< Store dry and wet materials under cover, away from drainage areas.
< Avoid mixing excess amounts of fresh concrete or cement on-site.
< Perform washout of concrete trucks off-site or in designated areas only.
< Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
< Do not allow excess concrete to be dumped on-site, except in designated areas.
< When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water within a bermed or level area. (See Earth Berm Barrier information sheet.)
< Train employees and subcontractors in proper concrete waste management.

LIMITATIONS:

< Off-site washout of concrete wastes may not always be possible.

MAINTENANCE:

< Inspect subcontractors to ensure that concrete wastes are being properly managed.
< If using a temporary pit, dispose hardened concrete on a regular basis.

OBJECTIVES

9 Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
: Other Waste

IMPLEMENTATION REQUIREMENTS

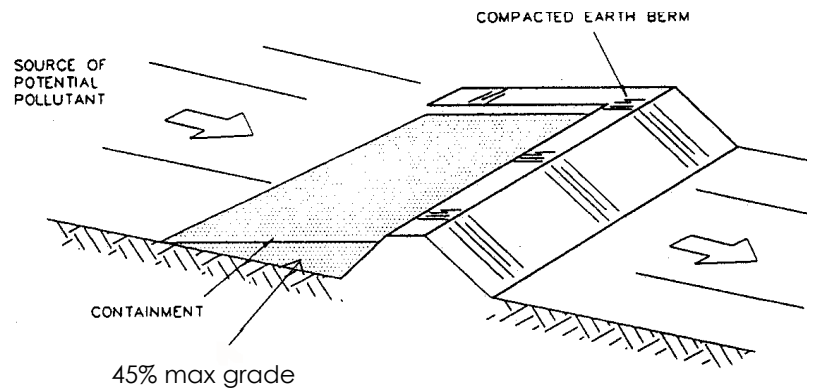
9 Capital Costs
9 O&M Costs
: Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adoped from Salt Lake County Engineering Division Guidance Document

BMP: Earth Berm Barrier

EB



DESCRIPTION:

A temporary containment control constructed of compacted soil.

APPLICATION:

< Construct around waste and materials storage area.
< Construct around staging and maintenance areas.
< Construct around vehicle parking and servicing areas.

INSTALLATION/APPLICATION CRITERIA:

< Construct an earthen berm down hill of the area to be controlled. The berm should surround fueling facilities and maintenance areas on three sides to provide containment.
< Berm needs to be a minimum of 1 foot tall by 1 foot wide and be compacted by earth moving equipment.

LIMITATIONS:

< Not effective on steep slopes.
< Limits access to controlled area.
< Personnel need to quickly respond to spills with remedial actions.

MAINTENANCE:

< Observe daily for any non-stormwater discharge.
< Look for runoff bypassing ends of berms or undercutting berms.
< Repair or replace damaged areas of the berm and remove accumulated sediment.
< Recompact soil around berm as necessary to prevent piping.

OBJECTIVES

9 Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
: Control Site Perimeter
9 Control Internal Erosion

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3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Construction Waste

IMPLEMENTATION REQUIREMENTS

: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPTED FROM SSALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Hazardous Waste Management

HWM

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste throughproper material use,waste disposal,and training of employees and subcontractors.

APPLICATION:

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

< Paints and Solvents; petroluem products sucha s oils, fuels, and grease; herbicides and pesticides; Acids for cleaning masonry; and concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with Federal, State, and local regulations, including:

< Sandblasting grit mixed with lead, cadmium, or chromium-based paints; Asbestos; and PCB's.

INSTALLATION/APPLICATION CRITERIA:

The following steps will help reduce storm water pollution from hazardous wastes:

< Use all of the product before disposing of the container.

< Do not remove the original product label, it contains important safety and disposal information.

< Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with Federal and State regulations.

LIMITATIONS:

Hazardous wastethat cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.

MAINTENANCE:

< Inspect hazardous waste receptacles and area regularly.

< Arrange for regular hazardous waste collection.

Materials Adopted From Salt Lake County Engineering Division Guidance Document

OBJECTIVES

9 Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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West Valley City Engineering Division
3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
: Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

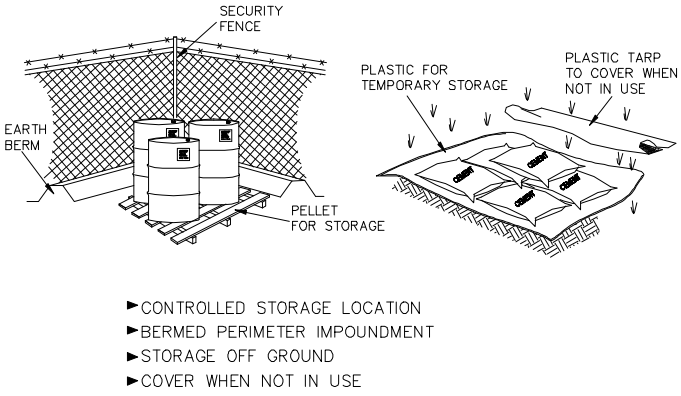
IMPLEMENTATION REQUIREMENTS

9 Capital Costs
9 O&M Costs
: Maintenance
: Training

■ High **:** Medium **9** Low

BMP: Materials Storage

MS



►CONTROLLED STORAGE LOCATION
►BERMED PERIMETER IMPOUNDMENT
►STORAGE OFF GROUND
►COVER WHEN NOT IN USE

DESCRIPTION:

Controlled storage of on-site materials.

APPLICATION:

< Storage of hazardous, toxic, and all chemical substances.
< Any construction site with outside storage of materials.

INSTALLATION/APPLICATION CRITERIA:

< Designate a secured area with limited access as the storage location. Ensure no waterways or drainage paths are nearby.
< Construct compacted earthen berm (See Earth Berm Barrier Information Sheet), or similar perimeter containment around storage location for impoundment in the case of spills.
< Ensure all on-site personnel utilize designated storage area. Do not store excessive amounts of material that will not be utilized on site.
< For active use of materials away from the storage area ensure materials are not set directly on the ground and are covered when not in use. Protect storm drainage during use.

LIMITATIONS:

< Does not prevent contamination due to mishandling of products.
< Spill Prevention and Response Plan still required.
< Only effective if materials are actively stored in controlled location.

MAINTENANCE:

< Inspect daily and repair any damage to perimeter impoundment or security fencing.
< Check materials are being correctly stored (i.e. standing upright, in labeled containers, tightly capped) and that no materials are being stored away from the designated location.

OBJECTIVES

: Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Toxic Materials
9 Oil & Grease
9 Floatable Materials
: Other Waste

IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
: Maintenance
■ Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Material Use

MU

DESCRIPTION:

Applying materials such as vinyl, asphalt, plastics, or rubber on an unprotected slope to temporarily stabilize the slope.

APPLICATIONS:

< As a tacking agent to aid the stabilization of mulches (where matting is not used).
< As a short-term alternative in areas where temporary seeding practices cannot be used because of seasonal condition or climate.
< On steep and rocky slopes where neither mechanical methods or mulches and protective netting can be effectively applied.

INSTALLATION/APPLICATION CRITERIA:

< The application rates and procedures recommended by the manufacturer of a chemical stabilization product should be followed to prevent the products from forming ponds and from creating large areas where moisture cannot get through.
< For permanent application, chemical mulches (when used with seed and mulch) should be applied over wood fiber or straw mulch.

LIMITATIONS:

< Chemical mulches can create impervious surfaces and impact water quality if not properly applied.
< Some products may not be suitable for use near live streams.

MAINTENANCE:

< Inspect at regular intervals and after each runoff-producing storm event.
< Replace chemical mulch as needed to ensure adequate level of coverage.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Toxic Materials
9 Oil & Grease
9 Floatable Materials
■ Other Waste

IMPLEMENTATION REQUIREMENTS

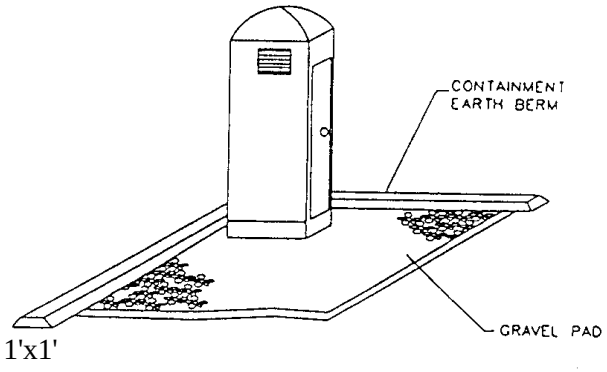
9 Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adapted From Salt Lake Country Engineering Division Guidance Document

BMP: Portable Toilets

PT



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DESCRIPTION:
Temporary on-site sanitary facilities for construction personnel.

APPLICATION:
All sites with no permanent sanitary facilities or where permanent facility is too far from activities.

INSTALLATION/APPLICATION CRITERIA:
< Locate portable toilets in convenient locations throughout the site.
< Prepare level, gravel surface and provide clear access to the toilets for servicing and for on-site personnel.
< Construct earth berm perimeter (See Earth Berm Barrier Information Sheet), control for spill/protection leak.

LIMITATIONS:
No limitations.

MAINTENANCE:
< Portable toilets should be maintained in good working order by licensed service with daily observation for leak detection.
< Regular waste collection should be arranged with licensed service.
< All waste should be deposited in sanitary sewer system for treatment with appropriate agency approval.

OBJECTIVES

: Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
■ Other Waste

IMPLEMENTATION REQUIREMENTS

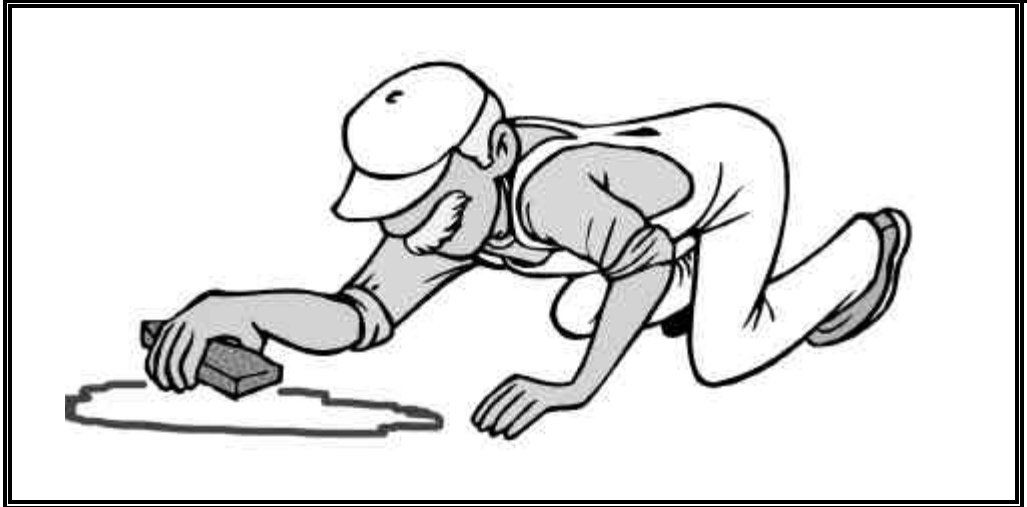
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

MATERIALS ADOPTED FROM SSALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Spill Clean-Up

SCU



DESCRIPTION:
Practices to clean-up leakage/spillage of on-site materials that may be harmful to receiving waters.

APPLICATION:
All sites

GENERAL:
< Store controlled materials within a storage area.
< Educate personnel on prevention and clean-up techniques.
< Designate an Emergency Coordinator responsible for employing preventative practices and for providing spill response.
< Maintain a supply of clean-up equipment on-site and post a list of local response agencies with phone numbers.

METHODS:
< Clean-up spills/leaks immediately and remediate cause.
< Use as little water as possible. NEVER HOSE DOWN OR BURY SPILL CONTAMINATED MATERIAL.
< Use rags or absorbent material for clean-up. Excavate contaminated soils. Dispose of clean-up material and soil as hazardous waste.
< Document all spills with date, location, substance, volume, actions taken and other pertinent data.
< Contact local Fire Department and State Division of Environmental Response and Remediation (Phone #536-4100) for any spill of reportable quantity.

OBJECTIVES

: Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Toxic Materials
: Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

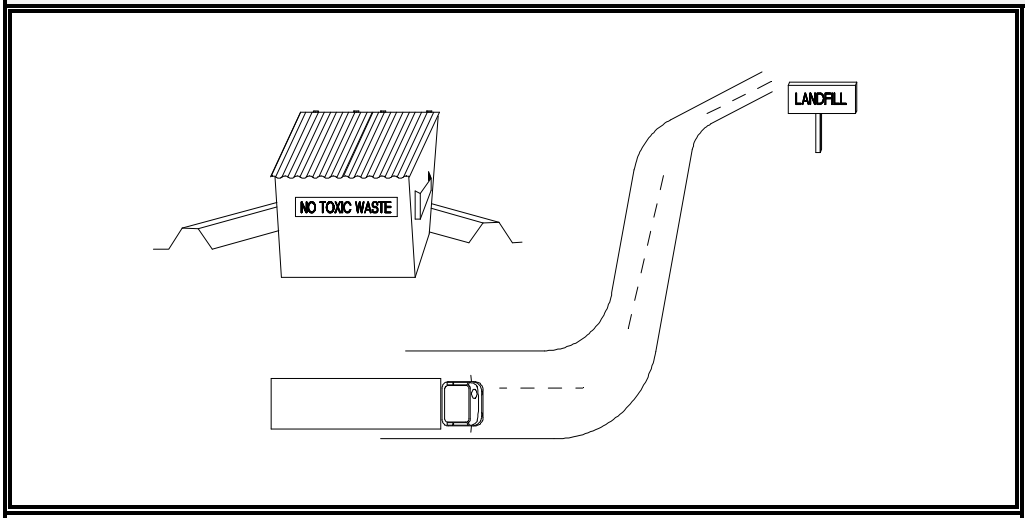
: Capital Costs
9 O&M Costs
9 Maintenance
■ Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Waste Disposal

WD



DESCRIPTION:

Controlled storage and disposal of solid waste generated by construction activities.

APPLICATION:

All construction sites.

INSTALLATION:

- < Designate one or several waste collection areas with easy access for construction vehicles and personnel. Ensure no waterways or storm drainage inlets are located near the waste collection areas.
- < Construct compacted earthen berm (See Earth Berm Barrier Information Sheet), or similar perimeter containment around collection area for impoundment in the case of spills and to trap any windblown trash.
- < Use water tight containers with covers to remain closed when not in use. Provide separate containers for different waste types where appropriate and label clearly.
- < Ensure all on site personnel are aware of and utilize designated waste collection area properly and for intended use only (e.g. all toxic, hazardous, or recyclable materials shall be properly disposed of separately from general construction waste).
- < Arrange for periodic pickup, transfer and disposal of collected waste at an authorized disposal location. Include regular Porto-potty service in waste management activities.

LIMITATIONS:

- < On-site personnel are responsible for correct disposal of waste.

MAINTENANCE:

- < Discuss waste management procedures at progress meetings.
- < Collect site trash daily and deposit in covered containers at designated collection areas.
- < Check containers for leakage or inadequate covers and replace as needed.
- < Randomly check disposed materials for any unauthorized waste (e.g. toxic materials).
- < During daily site inspections check that waste is not being incorrectly disposed of on-site (e.g. burial, burning, surface discharge, discharge to storm drain).

Materials Adopted From Salt Lake County Engineering Division Guidance Document

OBJECTIVES

: Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Toxic Materials
9 Oil & Grease
9 Floatable Materials
■ Other Waste

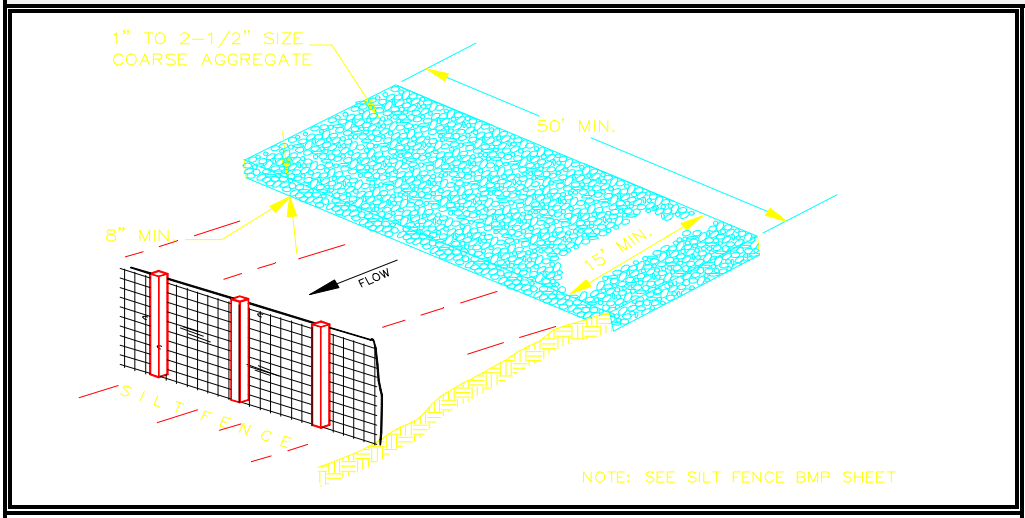
IMPLEMENTATION REQUIREMENTS

■ Capital Costs
■ O&M Costs
: Maintenance
■ Training

■ High : Medium **9** Low

BMP: Equipment and Vehicle Wash Down Area

EVWA



DESCRIPTION:

A stabilized pad of crushed stone for general washing of equipment and construction vehicles.

APPLICATION:

At any site where regular washing of vehicles and equipment will occur. May also be used as a filling point for water trucks limiting erosion caused by overflow or spillage of water.

INSTALLATION/APPLICATION CRITERIA:

< Clear and grub area and grade to provide maximum slope of 1%
< Compact subgrade and place filter fabric if desired (recommended for wash areas to remain in use for more than 3 months).
< Place coarse aggregate, 1 to 2-1/2 inches in size, to a minimum depth of 8-inches.
< Install silt fence downgradient (see silt fence BMP information sheet).

LIMITATIONS:

Cannot be utilized for washing equipment or vehicles that may cause contamination of runoff such as fertilizer equipment or concrete equipment. Solely used to control sediment in wash water.

MAINTENANCE:

< Inspect daily for loss of gravel or sediment buildup.
< Inspect adjacent area for sediment deposit and install additional controls as necessary.
< Repair area and replace gravel as required to maintain control in good working condition.
< Expand stabilized area as required to accomodate activities.
< Maintain silt fence as outlined in specific silt fence BMP information sheet.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
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9 Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
■ Toxic Materials
■ Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

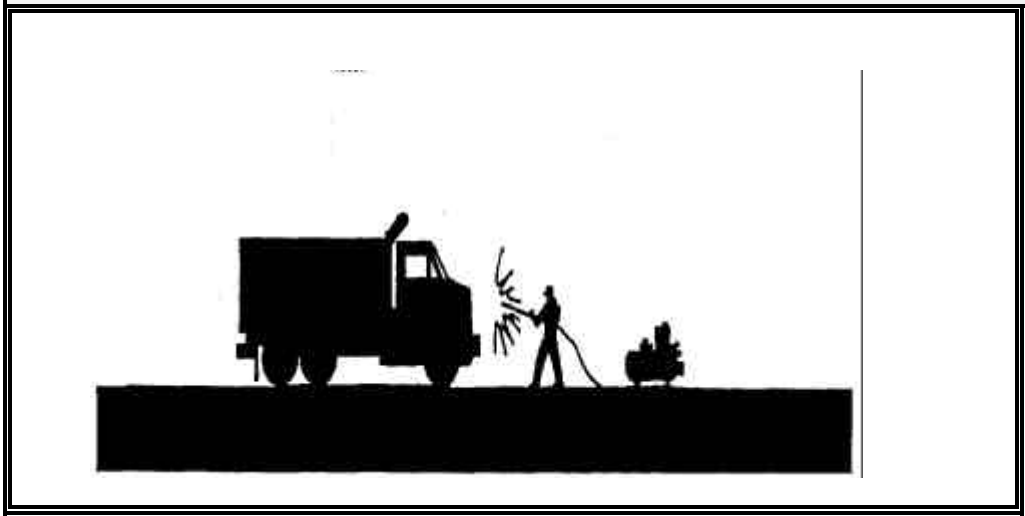
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

MATERIALS ADOPTED FROM SALT LAKE COUNTY ENGINEERING DOCUMENT

BMP: Vehicle And Equipment Cleaning

VEC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment cleaning by using off-site facilities, washing in designated, contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and/or training employees and subcontractors.

INSTALLATION/APPLICATION:

< Use off-site commercial washing businesses as much as possible. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute storm water. If you wash a large number of vehicles or pieces of equipment, consider conducting this work at an off-site commercial business. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work off-site can also be economical by eliminating the need for a separate washing operation at your site.

< If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with storm water, creeks, rivers, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground.

< Use as little water as possible to avoid having to install erosion and sediment controls for the wash area. Use phosphate-free biodegradable soaps. Educate employees and subcontractors on pollution prevention measures. Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations.

LIMITATIONS:

< Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.

< Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance.

MAINTENANCE:

< Minimal, some berm repair may be necessary.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
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: Medium Impact
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9 Other Waste

IMPLEMENTATION REQUIREMENTS

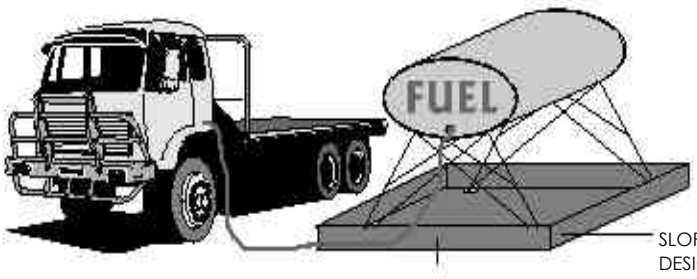
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Vehicle And Equipment Fueling

VEF



SLOPED OR OTHERWISE DESIGNED FOR EASY REMOVAL OF LEAKED FUEL

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

DESCRIPTION:

Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

INSTALLATION/APPLICATION:

< Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute storm water. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.

< If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of storm water and the runoff of spills. Discourage"topping-off" of fuel tanks.

< Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks. Place a stockpile of spill cleanup materials where it will be readily accessible. Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.

< Carry out all Federal and State requirements regarding stationary above ground storage tanks.(40 CF Sub. J) Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time. Train employees and subcontractors in proper fueling and cleanup procedures.

LIMITATIONS:

Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance.

MAINTENANCE:

< Keep ample supplies of spill cleanup materials on-site.
< Inspect fueling areas and storage tanks on a regular schedule.

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
: Toxic Materials
: Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

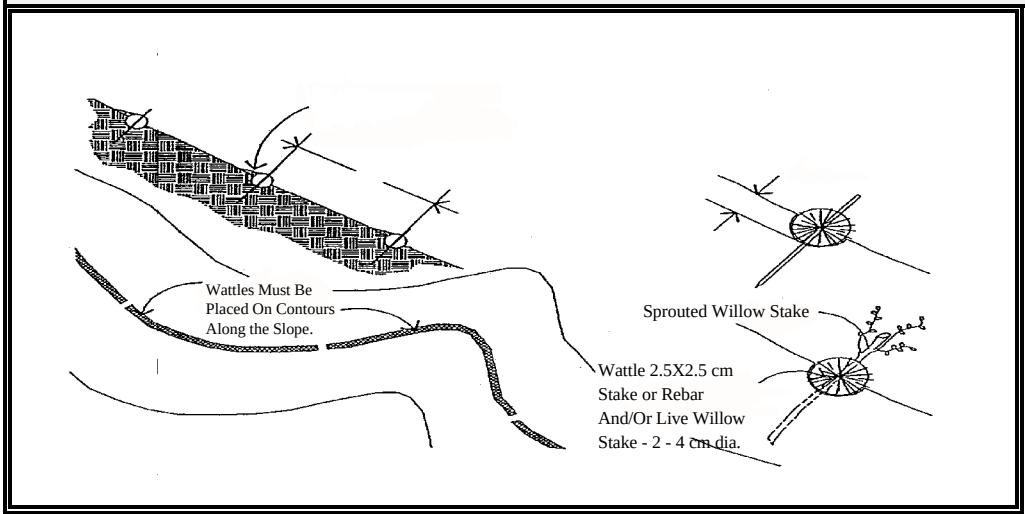
: Capital Costs
9 O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Bioengineering

BIO



General Description:

Bioengineering methods combine vegetative and mechanical techniques to stabilize eroding slopes. Bioengineering methods include sprigging, tubeling, and wattling. Sprigging involves planting rhizomes, stolons, shoots, or sprouts of a desirable species. Tubelings are forbs, shrubs, or trees commercially available in reusable plastic tubes or sleeves. Wattles are bundles of cuttings from live willows, alders, or similar plants placed and secured in trenches across a slope to aid in slope stabilization.

Applications:

< Sprigging may be performed on cut and fill slopes or other areas needing permanent soil stability.
< Tubelings may be placed on any area needing revegetation, but are most useful on slopes or flat areas where poor topsoil conditions inhibit successful seed germination and early plant growth.
< Wattlings act to reduce slope length and aid in stabilizing slopes due to surface runoff, frost heaving, needle ice, or other soil movement.

Installation/Application Criteria:

< Sprigging involves tearing sod apart, planting rhizomes or stolons, or transplanting shoots or sprouts. Sprigs are placed by broadcast, punching-in or with a special sprig planter.
< Tubelings involve drilling holes to the depth necessary to accomodate roots.
< Wattles are best applied to slopes no steeper than 2:1.

Limitations:

< Availability of plant materials may affect what species can be used.
< May be necessary to arrange for commercially grown tubelings.
< Cannot be used as a substitute for retaining walls or similar devices to stabilize oversteepened slopes.

Maintenance:

< Sprigging and tubeling plantings should be checked periodically until they are permanently established.
< Assess the need for replacement plantings or supplemental fertilizer.
< The wattlings should be inspected at regular intervals to make sure bundles are still secure and check for sprouting of the wattling material.

Materials Adapted From Salt lake County Engineering Division Guidance Document

Objectives

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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Targeted Pollutants

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

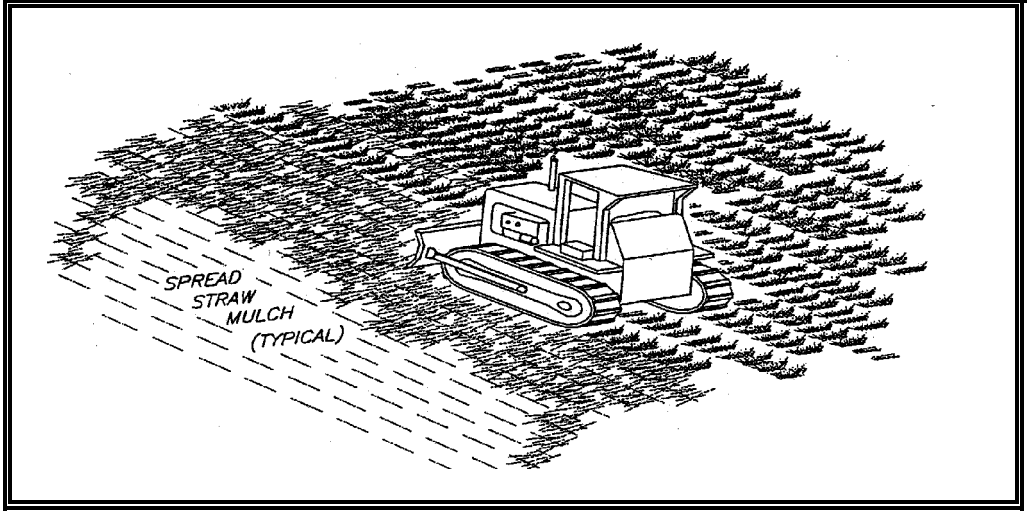
Implementation Requirements

: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

BMP: Chemical Mulch

CM



DESCRIPTION:

Applying materials such as vinyl, asphalt, plastics, or rubber on an unprotected slope to temporarily stabilize the slope.

APPLICATIONS:

- As a tacking agent to aid the stabilization of mulches (where matting is not used).
- As a short-term alternative in areas where temporary seeding practices cannot be used because of seasonal condition or climate.
- On steep and rocky slopes where neither mechanical methods or mulches and protective netting can be effectively applied.

INSTALLATION/APPLICATION CRITERIA:

- The application rates and procedures recommended by the manufacturer of a chemical stabilization product should be followed to prevent the products from forming ponds and from creating large areas where moisture cannot get through.
- For permanent application, chemical mulches (when used with seed and mulch) should be applied over wood fiber or straw mulch.

LIMITATIONS:

- Chemical mulches can create impervious surfaces and impact water quality if not properly applied.
- Some products may not be suitable for use near live streams.

MAINTENANCE:

- Inspect at regular intervals and after each runoff-producing storm event.
- Replace chemical mulch as needed to ensure adequate level of coverage.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

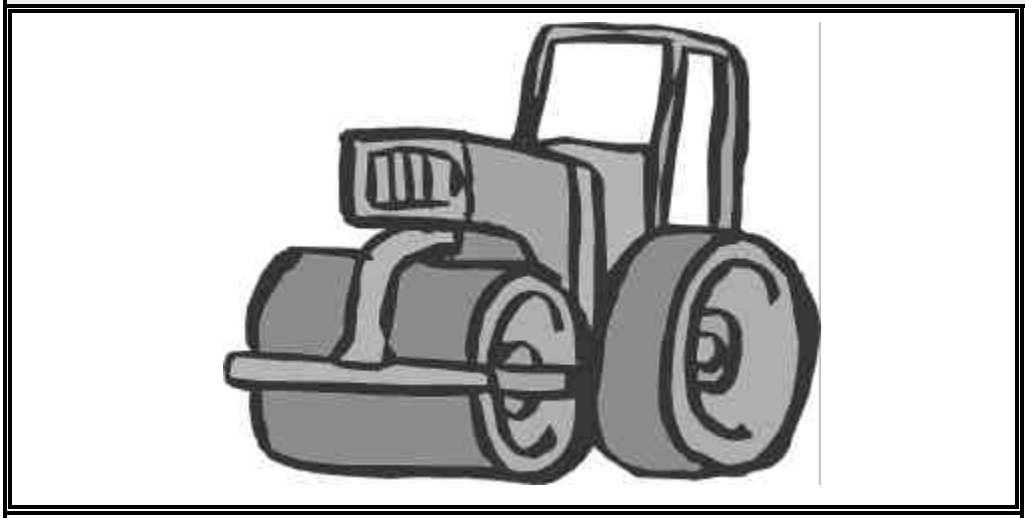
: Capital Costs
9 O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adapted From Salt Lake Country Engineering Division Guidance Document

BMP: Compaction

CP



DESCRIPTION:

Use of rolling, tamping, or vibration to stablize fill materials and control erosion by increasing the soil density. Increasing the density of soil improves soil strength, reduces long-term soil settlement, and provides resistance to erosion.

APPLICATIONS:

< Stabilize fill material placed around various structures.
< Improve soil in place as foundation support for roads, parking lots, and buildings.

INSTALLATION/APPLICATION CRITERIA:

< Make sure soil moisture content is at optimum levels.
< Use proper compaction equipment.
< Install sediment control and storm water management devices below compacted areas and runon interceptor devices above these areas. Drainage from compacted areas must be carefully planned to protect adjacent uncompacted soils.
< The surface of compacted areas should be scarified and seeded or mulched and seeded to increase the effectiveness of compaction.

LIMITATIONS:

< Compaction tends to increase runoff.
< Over-compaction will hamper revegetation efforts.

MAINTENANCE:

No maintenance required.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
: Minimize Disturbed Areas
: Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

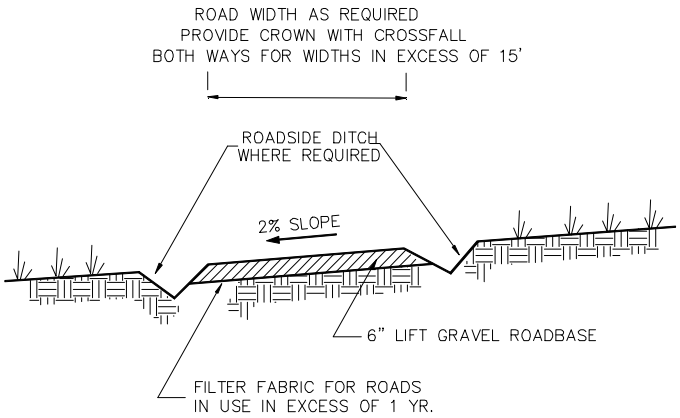
: Capital Costs
: O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adapted From Salt Lake County Engineering Division Guidance Document

BMP: Construction Road Stabilization

CR



DESCRIPTION:

Temporary stabilization of on-site roadway by placement of gravel roadbase.

APPLICATION:

< On-site roadways used daily by construction traffic (may not apply to gravelly type soils)
< Parking or staging areas susceptible to erosion due to traffic use

INSTALLATION/APPLICATION CRITERIA:

< Grade temporary access road with 2% cross fall, for two-way width provide crown.
< Provide roadside ditch and outlet controls where required.
< Place 6 inches of 2-inch to 4-inch crushed rock on driving area

LIMITATIONS:

< May require removal of gravel roadbase at completion of activities if final cover is not impervious
< May require controls for surface storm water runoff

MAINTENANCE:

< Inspect after major rainfall events and at least monthly.
< Place additional gravel as needed and repair any damaged areas.
< Maintain any roadside drainage controls.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
: Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Contaminated or Erodible Surface Areas

CESA

DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from contaminated or erodible surface areas by leaving as much vegetation on-site as possible, minimizing soil exposure time, stabilizing exposed soils, and preventing storm water runon and runoff.

APPLICATION:

This BMP addresses soils which are not so contaminated as to exceed criteria but the soil is eroding and carrying pollutants off in the storm water.

INSTALLATION/APPLICATION CRITERIA:

Contaminated or erodible surface areas can be controlled by:
Preservation of natural vegetation, re-vegetation, chemical stabilization, removal of contaminated soils or geosynthetics.

LIMITATIONS:

Disadvantages of preserving natural vegetation or re-vegetating include:

< Requires substantial planning to preserve and maintain the existing vegetation.
< May not be cost-effective with high land costs.
< Lack of rainfall and/or poor soils may limit the success of re-vegetated areas.
< Disadvantages of chemical stabilization include:
< Creation of impervious surfaces.
< May cause harmful effects on water quality.
< Is usually more expensive than vegetative cover.

MAINTENANCE:

Maintenance should be minimal, except possibly if irrigation of vegetation is necessary.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
■ Toxic Materials
■ Oil & Grease
■ Floatable Materials
■ Other Waste

IMPLEMENTATION REQUIREMENTS

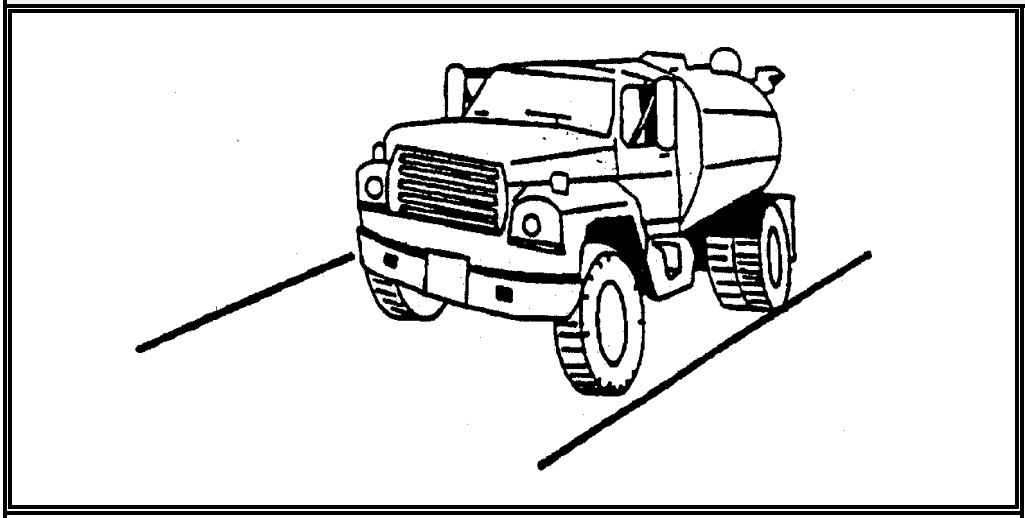
: Capital Costs
: O&M Costs
9 Maintenance
9 Training

■ High : Medium **9** Low

Materials Adapted From Salt Lake County Engineering Division Guidance Document

BMP: Dust Controls

DC



DESCRIPTION:
Dust control measures are used to stabilize soil from wind erosion, and reduce dust by construction activities.

APPLICATION:
Dust control is useful in any process area, loading and unloading area, material handling areas, and transfer areas where dust is generated. Street sweeping is limited to areas that are paved.

INSTALLATION/APPLICATION CRITERIA:
< Mechanical dust collection systems are designed according to the size of dust particles and the amount of air to be processed. Manufacturers' recommendations should be followed for installation (as well as the design of the equipment).
< Two kinds of street weepers are common: brush and vacuum. Vacuum sweepers are more efficient and work best when the area is dry.
< Mechanical equipment should be operated according to the manufacturers' recommendations and should be inspected regularly.

LIMITATIONS:
< Is generally more expensive than manual systems.
< May be impossible to maintain by plant personnel (the more elaborate equipment).
< Is labor and equipment intensive and may not be effective for all pollutants (street sweepers).

MAINTENANCE:
If water sprayers are used, dust-contaminated waters should be collected and taken for treatment. Areas will probably need to be resprayed to keep dust from spreading.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
: Minimize Disturbed Areas
: Stabilize Disturbed Areas
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9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

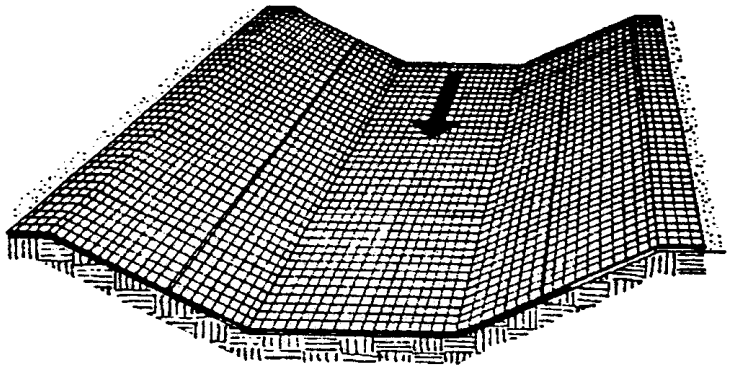
: Capital Costs
9 O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Erosion Control Blankets

ECB



DESCRIPTION:

Erosion control blankets are used in place of mulch on areas of high velocity runoff and/or steep grade, to aid in controlling erosion on critical areas by protecting young vegetation.

APPLICATIONS:

< Where vegetation is likely to grow too slowly to provide adequate cover.
< In areas subject to high winds where mulch would not be effective.

INSTALLATION/APPLICATION CRITERIA:

< Install erosion control blankets parallel to the direction of the slope.
< In ditches, apply in direction of the flow.
< Place erosion control blankets loosely on soil - do not stretch.
< Ends of blankets should be buried no less than six inches deep.
< Staple the edges of the blanket at least every three feet.

LIMITATIONS:

< Not recommended in areas which are still under construction.

MAINTENANCE:

< Check for erosion and undermining periodically, particularly after rainstorms.
< Repair dislocations or failures immediately.
< If washouts occur, reinstall after repairing slope damage.
< Monitor until permanently stabilized.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
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: Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

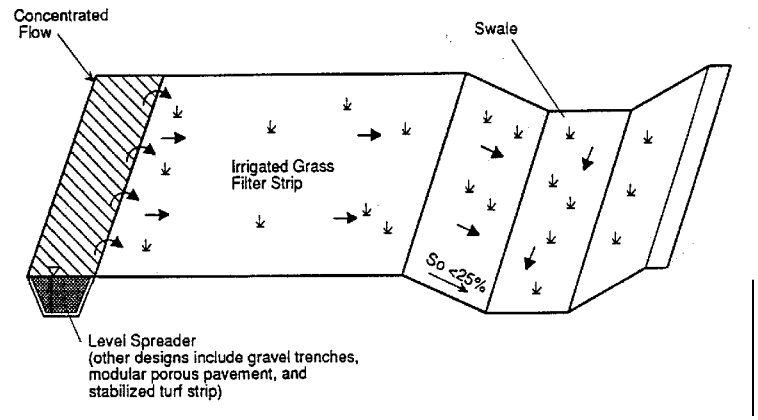
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Guidance Document

BMP: Filter Strips

FS



General Description:

Filter strips are 20-foot-wide strips of natural or planted vegetation around a construction site. They are designed to cause deposition of sediments within the vegetation layer.

Applications:

< Suited for areas where the soils are well drained or moderately well drained.
< Areas where the bedrock and the water table are well below the surface.

Installation/Application Criteria:

< Make sure the vegetative cover is dense enough to protect underlying soil while causing sediment to settle.
< Filter strip must be approximately 20 feet wide to function well.
< The length should be approximately 50 to 75 feet. Where slopes become steeper the length of the strip must be increased.

Limitations:

< Only applicable in areas where vegetation is previously established or where sod is added.
< Vegetated filter strips will not function well on steep slopes, in hilly areas, or in highly paved areas.
< Sites with slopes of 15 percent or more may not be suitable for filtering storm water flows.

Maintenance:

< Check for channels and repair.
< Provide rock aprons to aid in slowing flow if necessary.
< Maintain vegetation at optimal height and thickness.

Objectives

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
: Control Site Perimeter
9 Control Internal Erosion

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Targeted Pollutants

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

Implementation Requirements

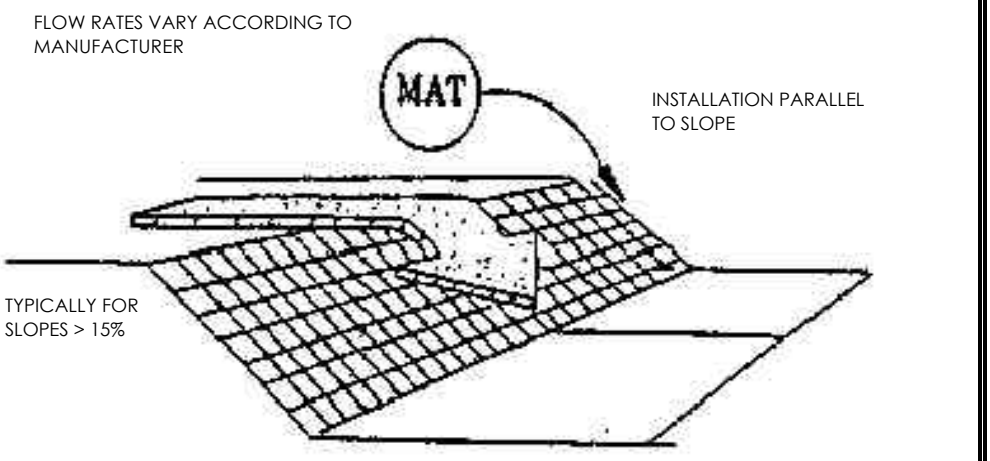
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP:Geotextiles and Mats

GM



DESCRIPTION:

Mattings made of natural or synthetic material which are used to temporarily or permanently stabilize soil.

APPLICATION:

< Typically suited for post-construction site stabilization, but may be used for temporary stabilization of highly erosive soils.
< Channels and streams.
< Steep slopes.

INSTALLATION/APPLICATION CRITERIA:

< Mattings may be applied to disturbed soils and where existing vegetation has been removed.
< The following organic matting materials provide temporary protection until permanent vegetation is established, or when seasonal circumstances dictate the need for temporary stabilization until weather or construction delays are resolved: Jute mattings and straw mattings.
< The following synthetic mattings may be used for either temporary or post-construction stabilization, both with and without vegetation: excelsior matting, glass fiber matting, mulch matting.
< Staples are needed to anchor the matting.

LIMITATIONS:

< Mattings are more costly than other BMP practices, limiting their use to areas where other BMPs are ineffective (e.g., channels, steep slopes).
< May delay seed germination, due to reduction in soil temperature.
< Installation requires experienced contractor to ensure soil stabilization and erosion protection.

MAINTENANCE:

< Inspect monthly and after significant rainfall.
< Re-anchor loosened matting and replace missing matting and staples as required.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Hydromulching

HM

DESCRIPTION:

A combination of wood fiber mulch, processed grass, or hay or straw mulch and a tacking agent. It is made into a slurry, then applied to bare slopes or other bare areas to provide temporary stabilization.

APPLICATIONS:

< Small roadside slopes.
< Large, relatively flat areas.

INSTALLATION/APPLICATION CRITERIA:

< Legume seeds should be pellet inoculated with the appropriate bacteria.
< The seed should not remain in the hydromulcher tank for more than 30 minutes.
< Wood fiber may be dyed to aid in uniform application.
< Slurry should be uniformly applied until an adequate coverage is achieved.
< The applicator should not be directed at one location for a long period of time; erosion will occur.

LIMITATIONS:

< Will lose effectiveness after 1 year.
< Can use only on physically stable slopes (at natural angle of repose, or less).

MAINTENANCE:

< Periodically inspect for damage caused by wind, water, or human disturbance.
< Promply repair damaged areas.

OBJECTIVES

9 Housekeeping Practices
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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

: Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

: Capital Costs
9 O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Mulching

MU

Material	Application	Depth	Comments
Gravel: Washed 1/4" to 1-1/2"	9 cy/1000 sf	3 inches	Good for traffic areas Good for short slopes
Straw: Air-dried, free of seeds and coarse material	2-3 bales /1000 sf	2 inches min.	Subject to wind blowing Tack down or keep moist
Wood Fiber Cellulose: Free from growth inhibitors; dyed green	35 lb/1000 sf	1 inch	For critical areas, double application rate; Limit to slopes < 3% and < 150 feet

DESCRIPTION:

Placement of material such as straw, grass, woodchips, woodfibers or fabricated matting over open area.

APPLICATION:

- Any exposed area to remain untouched longer than 14 days and that will be exposed less than 60 days (seed areas to be exposed in excess of 60 days).
- Areas that have been seeded.
- Stockpiled soil material.

INSTALLATION/APPLICATION CRITERIA:

- Roughen area to receive mulch to create depressions that mulch material can settle into.
- Apply mulch to required thickness and anchor as necessary.
- Ensure material used is weed free and does not contain any constituents that will inhibit plant growth.

LIMITATIONS:

- Anchoring may be required to prevent migration of mulch material.
- Downgradient control may be required to prevent mulch material being transported to storm water system.

MAINTENANCE:

- Inspect mulched areas after every rainfall event and at a minimum of monthly.
- Replace mulch on any bare areas and reanchor as necessary.
- Clean and replace downgradient controls as necessary.

OBJECTIVES

9 Housekeeping Practices
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TARGETED POLLUTANTS

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■ Sediment
: Nutrients
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9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

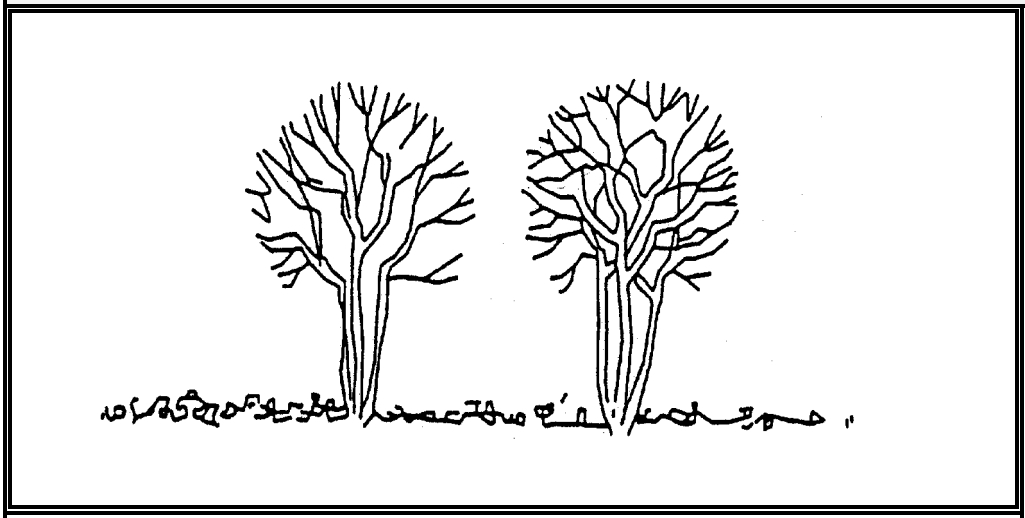
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Preservation of Existing Vegetation

PEV



GENERAL DESCRIPTION:

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs and/or grasses that serve as erosion controls.

APPLICATIONS:

This technique is applicable to all types of sites. Areas where preserving vegetation can be particularly beneficial are floodplains, wetlands, stream banks, steep slopes, and other areas where erosion controls would be difficult to establish, install, or maintain.

INSTALLATION/APPLICATION CRITERIA:

- < Clearly mark, flag or fence vegetation or areas where vegetation should be preserved.
- < Prepare landscaping plans which include as much existing vegetation as possible and state proper care during and after construction.
- < Define and protect with berms, fencing, signs, etc. a setback area from vegetation to be preserved.
- < Propose landscaping plans which do not include plant species that compete with the existing vegetation.
- < Do not locate construction traffic routes, spoil piles, etc. where significant adverse impact on existing vegetation may occur.

LIMITATIONS:

- < Requires forward planning by the owner/developer, contractor and design staff.
- < For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactorily for the planned development.
- < May not be cost effective with high land costs.

MAINTENANCE:

- < Inspection and maintenance requirements for protection of vegetation are low.
- < Maintenance of native trees or vegetation should conform to landscape plan specifications.

OBJECTIVES

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TARGETED POLLUTANTS

■ High Impact
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9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

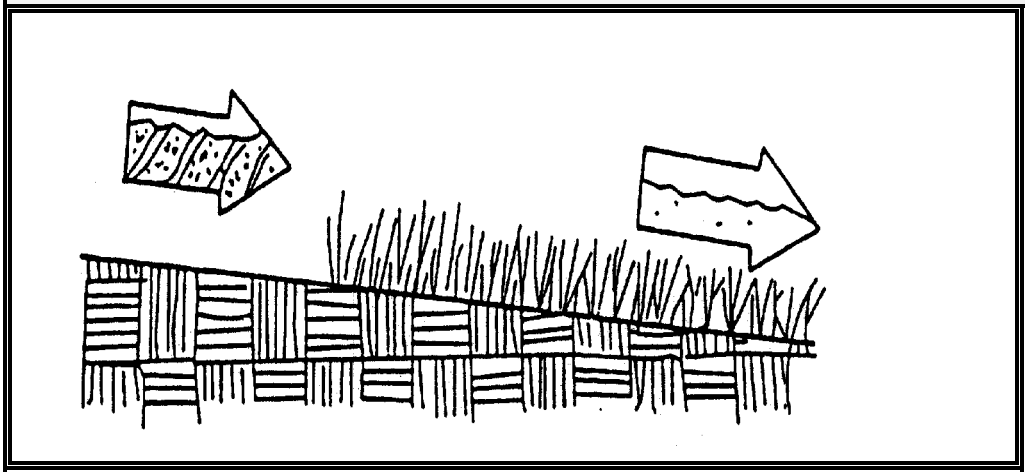
9 Capital Costs
9 O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: SEEDING AND PLANTING

SP



OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
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9 Control Site Perimeter
9 Control Internal Erosion

DESCRIPTION:

Seeding of grass and plantings of trees, shrubs, vines and ground covers provide long-term stabilization of soil. In some areas, with suitable climates, grasses can be planted for temporary stabilization.

APPLICATION:

< Appropriate for site stabilization both during construction and post-construction.
< Any graded/cleared areas where construction activities have ceased.
< Open space cut and fill areas.
< Steep slopes, spoil piles, vegetated swales, landscape corridors, stream banks.

INSTALLATION/APPLICATION CRITERIA:

Type of vegetation, site and seedbed preparation, planting time, fertilization and water requirements should be considered for each application.

Grasses:

< Ground preparation: fertilize and mechanically stabilize the soil.
< Tolerant of short-term temperature extremes and waterlogged soil composition.
< Appropriate soil conditions: shallow soil base, good drainage, slope 2:1 or flatter.
< Mowing, irrigating, and fertilizing are vital for promoting vigorous grass growth.

Trees and Shrubs:

< Selection criteria: vigor, species, size, shape & wildlife food source.
< Soil conditions: select species appropriate for soil, drainage & acidity.
< Other factors: wind/exposure, temperature extremes, and irrigation needs.

Vines and Ground Covers:

< Ground preparation: lime and fertilizer preparation.
< Use proper seeding rates.
< Appropriate soil conditions: drainage, acidity and slopes.
< Generally avoid species requiring irrigation.

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

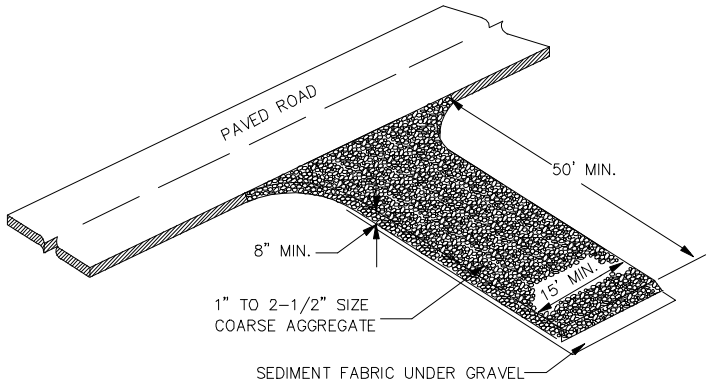
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Stabilized Construction Entrance

SCE



DESCRIPTION:

A stabilized pad of crushed stone located where construction traffic enters or leaves the site from or to paved surface.

APPLICATIONS:

At any point of ingress or egress at a construction site where adjacent traveled way is paved. Generally applies to sites over 2 acres unless special conditions exist.

INSTALLATION/APPLICATION CRITERIA:

< Clear and grub area and grade to provide maximum slope of 2%.
< Compact subgrade and place filter fabric if desired (recommended for entrances to remain for more than 3 months.
< Place coarse aggregate, 1 to 2-1/2 inches in size, to a minimum depth of 8 inches.

LIMITATIONS:

< Requires periodic top dressing with additional stones.
< Should be used in conjunction with street sweeping on adjacent public right-of-way.

MAINTENANCE:

< Inspect daily for loss of gravel or sediment buildup.
< Inspect adjacent roadway for sediment deposit and clean by sweeping or shoveling.
< Repair entrance and replace gravel as required to maintain control in good working condition.
< Expand stabilized area as required to accomodate traffic and prevent erosion at driveways.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
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TARGETED POLLUTANTS

■ High Impact
: Medium Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

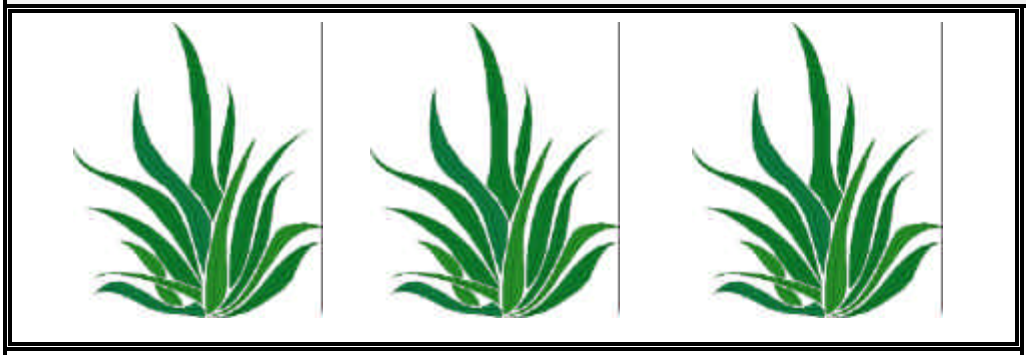
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

MATERIALS ADOPTED FROM SSALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Temporary and Permanent Seeding

TPS



OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
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9 Control Site Perimeter
9 Control Internal Erosion

DEFINITION:

Temporary seeding - establishment of short term cover by application of rapidly germinating seed mix (alternatively hydroseeding may be utilized).
Permanent seeding - establishment of final term cover by application of perennial seed mix (alternatively sod may be utilized).

APPLICATION:

Disturbed areas that are at final grade and which will not be disturbed by continuing activities on site. Also areas that are not at final grade but which will be left untouched in excess of one year.

RECOMMENDED SEED MIX:

The recommended seed mix will be dependent on site specific information such as elevation, exposure, soils, water available and topography. Check with the County Extension Service for recommended mixes for site specific conditions:

Utah State University Extension Service
2001 South State Street #S1200
Salt Lake City, Utah 84190
phone (801) 468-3170

LIMITATIONS:

< Limited to areas that will not be subject to traffic or high usage.
< May require irrigation and fertilizer which creates potential for impacting runoff quality.
< May only be applied during appropriate planting season, temporary cover required until that time.

INSTALLATION:

< Roughen soil to a depth of 2 inches. Add fertilizer, manure, topsoil as necessary.
< Evenly distribute seed using a commonly accepted method such as; breast seeding, drilling, hydroseeding.
< Use a seed mix appropriate for soil and location that will provide rapid germination and growth. Check with County for recommended mix and application rate.
< Cover area with mulch if required due to steep slopes or unsuitable weather conditions.

MAINTENANCE:

< Provide irrigation as required to establish growth and to maintain plant cover through duration of project.
< Reseed as necessary to provide 75% coverage
< Remediate any areas damaged by erosion or traffic.
< When 75% coverage is achieved inspect monthly for damage and remediate as necessary.

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

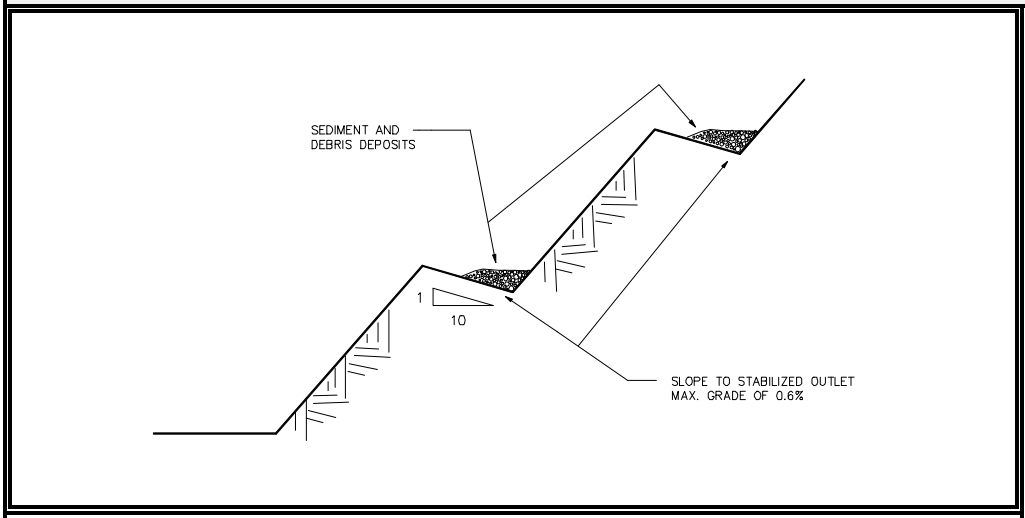
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Benching

BE



DESCRIPTION:

Slope construction with benches spaced at regular intervals perpendicular to the slope which intercept and collect sheet flow and direct it to a stable outfall point.

APPLICATION:

< Unstabilized cut and fill slopes
< Large stockpiles
< Existing unstable slopes

INSTALLATION/APPLICATION CRITERIA:

< Benches should be formed as slope is constructed and graded to the outlet point.
< Stabilized outlet with sediment controls should be in place prior to slope construction.

LIMITATIONS:

< Construction slope design must accomodate benching
< Not appropriate for sandy or rocky soil
< Only effective if suitable outlet provided

MAINTENANCE:

< Inspect after major storm events and at least biannually, repair any damaged areas
< Remove debris blocking water flow
< Inspect outlet, repair/replace sediment controls and remove sediment build up.

OBJECTIVES

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9 Minimize Disturbed Areas
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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
: Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

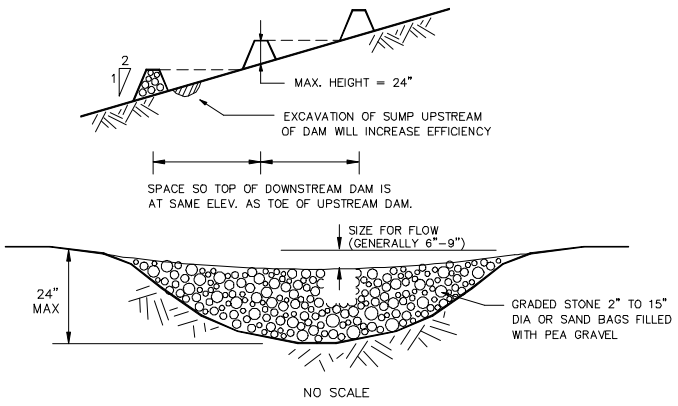
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADAPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Rock Check Dams

CD



DESCRIPTION:

A small, temporary dam constructed across a drainage ditch to reduce velocity of concentrated storm water flows, thereby reducing the erosion of the ditch.

APPLICATION:

< Temporary drainage paths
< Permanent drainage ways not yet stabilized
< Existing drainage paths receiving increased flows due to construction

INSTALLATION/APPLICATION CRITERIA:

< Prepare location of dam by removing any debris and rough grading any irregularities in channel bottom
< Place rocks by hand or with appropriate machinery, do not dump
< Construct dam with center lower to pass design flow
< Construct 50% side slopes on dam

LIMITATIONS:

< Maximum recommended drainage area is 10 acres
< Maximum recommended height is 24"
< Do not use in running stream

MAINTENANCE:

< Inspect dams daily during prolonged rainfall, after each major rain event and at a minimum of once monthly.
< Remove any large debris and repair any damage to dam, channel or sideslopes
< Remove accumulated sediment when it reaches one half the height of the dam

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
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9 Control Site Perimeter
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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

Sediment

9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

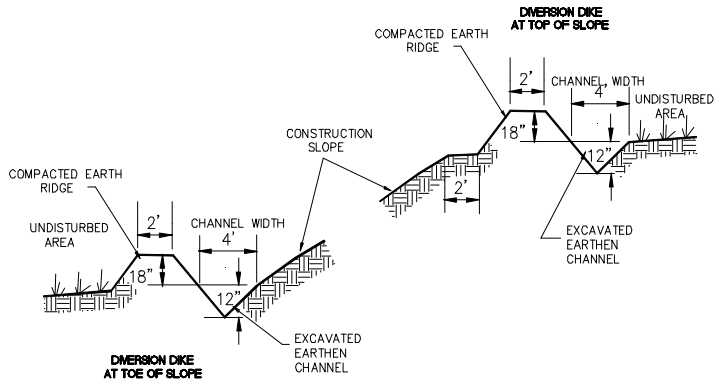
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADAPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Diversion Dike

DD



DESCRIPTION:

A temporary sediment barrier and storm runoff conveyance consisting of an excavation channel and compacted earth ridge.

APPLICATION:

< Construct along top of construction slope to intercept upgradient runoff and convey around construction site.
< Construct along toe of construction to divert sediment laden runoff.
< Construct along midpoint of construction slope to intercept runoff and channel to controlled discharge point.
< Construct around base of soil stockpiles to capture sediment.
< Construct around perimeter of disturbed areas to capture sediment.

INSTALLATION/APPLICATION CRITERIA:

< Clear and grub area for dike construction.
< Excavate channel and place soil on downgradient side.
< Shape and machine compact excavated soil to form ridge.
< Place erosion protection (riprap, mulch) at outlet.
< Stabilize channel and ridge as required with mulch, gravel, or vegetative cover.

LIMITATIONS:

< Recommended maximum drainage area of 5 acres
< Recommended maximum sideslopes of 2h:1v (50%)
< Recommended maximum slope on channel of 1%

MAINTENANCE:

< Inspect immediately after any rainfall and at least daily during prolonged rainfall.
< Look for runoff breaching dike or eroding channel or sideslopes.
< Check discharge point for erosion or bypassing of flows.
< Repair and stabilize as necessary.
< Inspect daily during vehicular activity on slope, check for and repair any traffic damage.

OBJECTIVES

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9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
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9 Other Waste

IMPLEMENTATION REQUIREMENTS

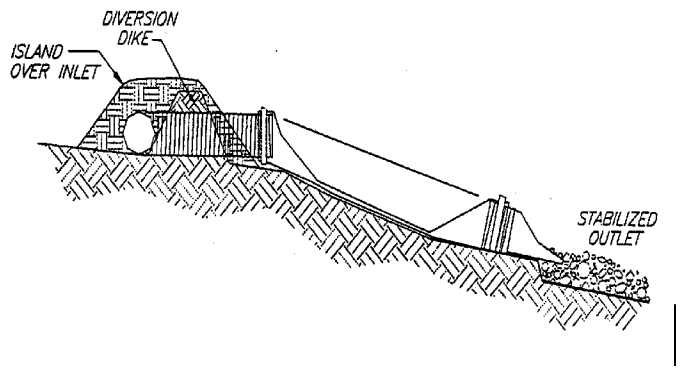
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Slope Drain

SD



DESCRIPTION:

A temporary pipe or lined channel that drains the top of a slope to a stable discharge point at the bottom of a slope without causing erosion.

APPLICATIONS:

< Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
< Drainage for top slope diversion dikes or swales.
< Emergency spillway for a sediment basin.
< Drainage for top of cut/fill slopes where water can accumulate.

INSTALLATION/APPLICATION CRITERIA:

< Secure inlet and surround with dikes to prevent gully erosion, and anchor pipe to slope.
< Size to convey at least the peak of a 10-year, storm event.
< Stabilize outlet. (See Outlet Protection BMP).

LIMITATIONS:

< Maximum drainage area per slope drain is 5 acres.
< Clogged slope drains will force water around the pipe and cause slope erosion.
< Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.
< Failure can result in flooding and severe erosion.

MAINTENANCE:

< Structure must be inspected weakly and after storms.
< Inlet must be free of undercutting and no water should circumvent the entry.
< Outlet should not produce erosion; velocity dissipators must be maintained.
< Pipe anchors must be checked to ensure that the pipe remains anchored to the slope.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

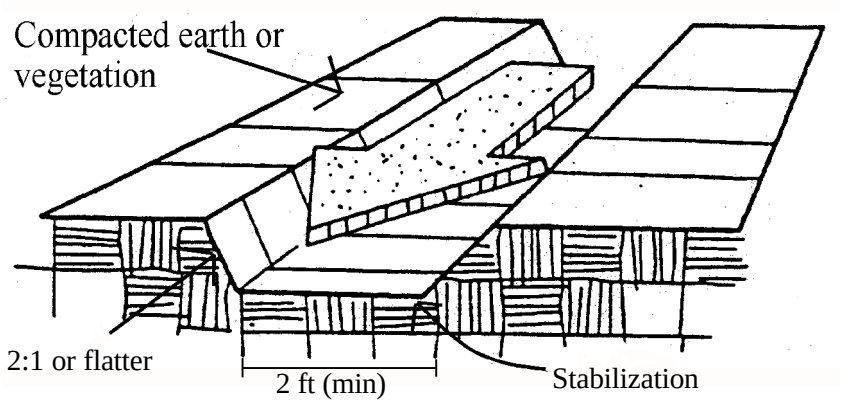
■ Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Temporary Drains And Swales

TDS



DESCRIPTION:

Temporary drains and swales are used to divert off-site runoff around the construction site, divert runoff from stabilized areas around disturbed areas, and direct runoff into sediment.

APPLICATIONS:

< Temporary drains and swales are appropriate for diverting any upslope runoff around unstabilized or disturbed areas of the construction site.
< Prevent slope failures. Prevent damage to adjacent property. Prevents erosion and transport of sediments into water ways. Increases the potential for infiltration. Diverts sediment-laden runoff into sediment basins or traps.

INSTALLATION/APPLICATION:

< Temporary drainage swales will effectively convey runoff and avoid erosion if built properly:
< Size temporary drainage swales using local drainage design criteria. A permanent drainage channel must be designed by a professional engineer (see the local drainage design criteria for proper design).
< At a minimum, the drain/swale should conform to predevelopment drainage patterns and capacities.
< Construct the drain/swale with an uninterrupted, positive grade to a stabilized outlet. Provide erosion protection or energy dissipation measures if the flow out of the drain or swale can reach an erosive velocity.

LIMITATIONS:

< Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
< Temporary drains and swales must conform to local floodplain management requirements.

MAINTENANCE:

< Inspect weekly and after each rain.
< Repair any erosion immediately.
< Remove sediment which builds up in the swale and restricts its flow capacity.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
: Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

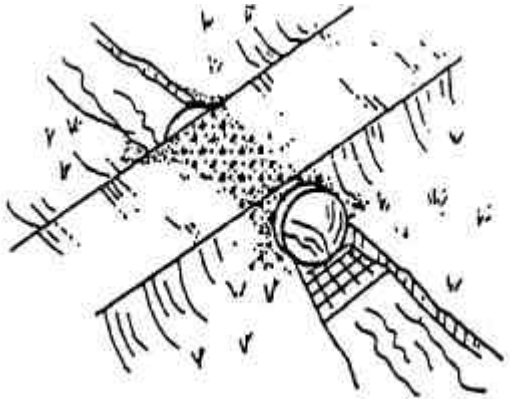
: Capital Costs
9 O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Temporary Stream Crossing

TSC



DESCRIPTION:

A temporary access stream crossing is a temporary culvert, ford or bridge placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not intended to be used to maintain traffic for the general public.

APPLICATIONS:

Temporary stream crossings should be installed at all designated crossings of perennial and intermittent streams on the sonctuction site, as well as for dry channels which may be significantly eroded by construction traffic.

INSTALLATION/APPLICATION:

Requires knowledge of stream flows and soil strength and should be designed under the direction of a Utah registered engineer with knowledge of both hydraulics and construction loading requirements for structures.

LIMITATIONS:

< May be an expensive for a temporary improvement.
< Requires other BMP's to minimize soil disturbance during installation and removal.
< Fords should only be used in dry weather.
< A Stream Alteration Permit may be required, contact the Utah Division of Water Rights before implemention.

MAINTENANCE:

< Inspect weekly and after each significant rainfall, including assessment of foundations.
< Periodically remove silt from crossings.
< Replace lost aggregated from inlets and outlets of culverts.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
: Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
: Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

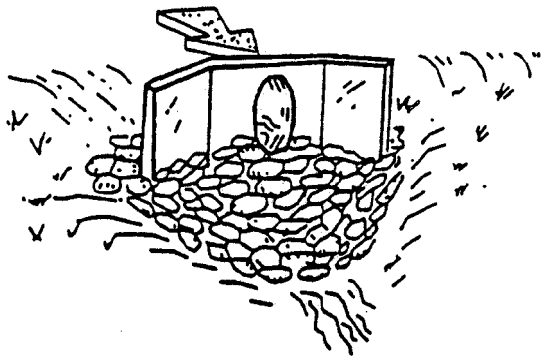
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Outlet Protection

OP



DESCRIPTION:

A rock outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble which is placed at the outlet of a pipe to prevent scour of the soil caused by high pipe flow velocities, and to absorb flow energy to produce non-erosive velocities.

APPLICATIONS:

< Wherever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach.
< Rock outlet protection is best suited for temporary use during construction becasue it is usually less expensive and easier to install than concrete aprons or energy dissipators.
< A sediment trap below the pipe outlet is recommended if runoff is sediment laden.
< Permanent rock riprap protection should be designed and sized by the engineer as part of the culvert, conduit or channel design.
< Grouted riprap should be avoided in areas of freeze and thaw because the grout will break up.

INSTALLATION/APPLICATION CRITERIA:

Rock outlet protection is effective when the rock is sized and placed properly. When this is accomplished, rock outlets do much to limit erosion at pipe outlets. Rock size should be increased for high velocity flows. Best results are obtained when sound, durable, angular rock is used.

LIMITATIONS:

< Large storms often wash away the rock outlet protection and leave the area susceptible to erosion.
< Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
< Outlet protection may negatively impact the channel habitat.

MAINTENANCE:

< Inspect after each significant rain for erosion and/or disruption of the rock, and repair immediately.
< Grouted or wire-tied rock riprap can minimize maintenance requirements.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

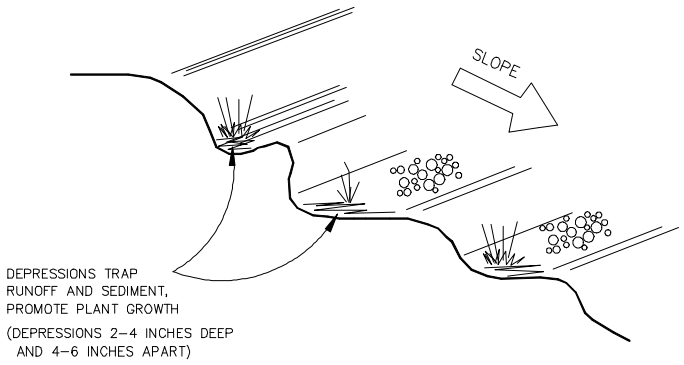
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Surface Roughening

SR



DESCRIPTION:

Rough preparation of working areas leaving depressions and uneven surface. Depressions should be done parrallel to contours.

APPLICATION:

Surface roughening is appropriate for all construction that will not be receiving impervious cover within 14 days and that will be exposed less than 60 days (seed areas to be open in excess of 60 days).

INSTALLATION/APPLICATION CRITERIA:

< Surface should be left in rough condition during initial earthwork activity.
< Surfaces that have become smoothed or compacted due to equipment traffic should be roughened by use of disks, spring harrows, teeth on front end loader, or similar, operating along the contours of the slope. Tracking (by crawler tractor driving up and down slope) may also be used to provide depressions parallel to contours.
< Avoid compaction of soils during roughening as this inhibits plant growth and promotes storm water runoff. Limit tracked machinery to sandy soil.
< Seed or mulch areas to be exposed in excess of 60 days.
< Employ dust controls. (See Dust Control Detail Sheet).

LIMITATIONS:

< Will not withstand heavy rainfall.
< Slopes steeper than 2:1 (50%) should be benched.(See Benching Detail Sheet).

MAINTENANCE:

< Inspect following any storm event and at a minimum of weekly.
< If erosion in the form of rills (small waterways formed by runoff) is evident, perform machine roughening of area.
< For vegetated slopes reseed areas that are bare or have been reworked.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

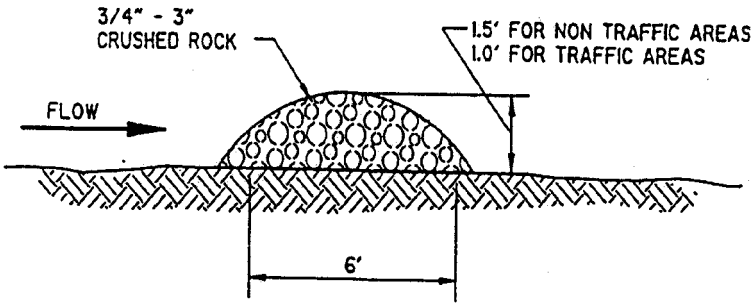
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Brush or Rock Filter

BRF



DESCRIPTION:

A rock filter is made of rock 3/4 - 3" in diameter and placed along a level contour. A brush filter is composed of brush (usually obtained during the site clearing) wrapped in filter cloth and anchored to the toe of the slope. If properly anchored brush or rock filters may be used for sediment trapping and velocity reduction.

APPLICATION:

- < As check dams across mildly sloped construction roads.
- < Below the toe of slopes.
- < Along the site perimeter.
- < In areas where sheet or rill flow occurs.
- < Around temporary spoil areas.
- < At sediment traps or culvert/pipe outlets.

INSTALLATION/APPLICATION CRITERIA:

- < For rock filter, use larger rock and place in a staked, woven wire sheathing if placed where concentrated flows occur.
- < Install along a level contour.
- < Leave area behind berm where runoff can pond and sediment can settle.
- < Drainage areas should not exceed 5 acres.

LIMITATIONS:

- < Rock berms may be difficult to remove.
- < Removal problems limit their usefulness in landscaped areas.
- < Runoff will pond upstream of the filter, possibly causing flooding if sufficient space does not exist.

MAINTENANCE:

- < Inspect monthly after each rainfall.
- < If berm is damaged, reshape and replace lost/dislodged rock.
- < Remove sediment when depth reaches 1/3 of berm height, or 1 ft.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
: Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ **Sediment**
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

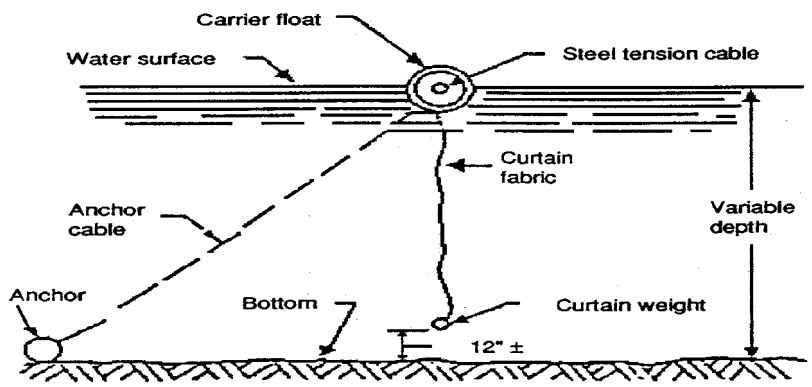
■ Capital Costs
: O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adapted From Salt Lake County Engineering Division Guidance Document

BMP: Flotation Silt Curtain

FSC



DESCRIPTION:

A flotation silt curtain is a silt barrier for use within a lake or pond. The flotation silt curtain consists of a filter fabric curtain weighted at the bottom and attached to a flotation device at the top. This structure is used to isolate an active construction area within a lake or pond to prevent silt-laden water from migrating out of the construction zone.

APPLICATIONS:

Where construction is conducted within a lake or pond area.

INSTALLATION/APPLICATION CRITERIA:

- The curtain should be constructed of a nylon fabric with a minimum tensile strenth of 300 pounds per inch of fabric.
- The top of the curtain should have a flotation carrier consisting of a floating plastic tube (6-inch minimum diameter) filled with marine quality polyethylene foam. The flotation carrier should also have a 5/16" diameter coated steel cable in it to carry loads imposed upon the curtain.
- The bottom edge should be weighted by cable or chain with a minimum weight of 1.1 pounds per foot.
- One 24-pound anchor should be used per 100 feet of curtain.
- Where the curtain is made up of sections, the sections should be joined so that silt cannot permeate through the connection.

LIMITATIONS:

Not recommended in very shallow water bodies.

MAINTENANCE:

The silt curtain should be maintained until the construction area is stabilized and turbidity is reduced to acceptable levels.

OBJECTIVES

9 Housekeeping Practices
: Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

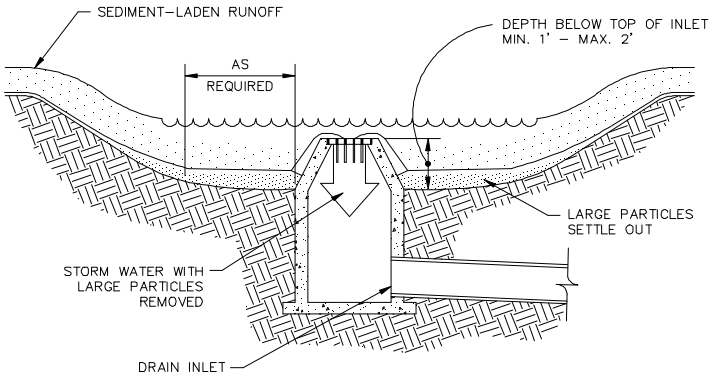
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Inlet Protection - Excavated

IP



DESCRIPTION:

An area excavated around a storm drain inlet to impound water below the inlet.

APPLICATION:

Construct at storm drainage inlets located downgradient of areas to be disturbed by construction (for inlets in paved areas see other information sheets for inlet protection).

INSTALLATION/APPLICATION CRITERIA:

- < Provide upgradient sediment controls, such as silt fence during construction of inlet.
- < When construction of inlet is complete, excavate adjacent area 1 to 2 feet lower than the grate elevation. Size of excavated area should be based on soil type and contributing acreage.

LIMITATIONS:

- < Recommended maximum contributing drainage area of one acre.
- < Limited to inlets located in open unpaved areas.
- < Requires flat area adjacent to inlet.

MAINTENANCE:

- < Inspect inlet protection following storm event and at a minimum of once monthly.
- < Remove accumulated sediment when it reaches one half of the excavated sump below the grate.
- < Repair side slopes as required.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
: Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

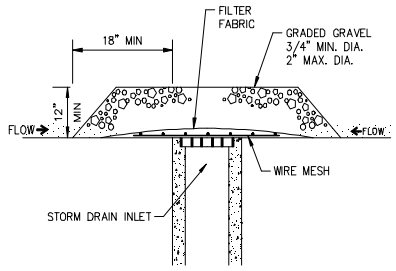
9 Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

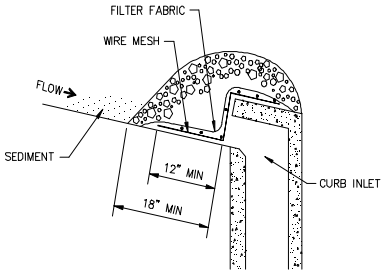
Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Inlet Protection - Gravel

IP



DROP INLET PROTECTION-GRAVEL



CURB INLET PROTECTION-GRAVEL

DESCRIPTION:

Placement of gravel filter over inlet to storm drain to filter storm water runoff.

APPLICATION:

Construct at inlets in paved or unpaved areas where upgradient area is to be disturbed by construction activities.

INSTALLATION/APPLICATION CRITERIA:

< Place wire mesh (with ½ inch openings) over the inlet grate extending one foot past the grate in all directions.
< Place filter fabric over the mesh. Filter fabric should be selected based on soil type.
< Place graded gravel, to a minimum depth of 12-inches, over the filter fabric and extending 18-inches past the grate in all directions.

LIMITATIONS:

< Recommended for maximum drainage area of one acre.
< Excess flows may bypass the inlet requiring down gradient controls.
< Ponding will occur at inlet.

MAINTENANCE:

< Inspect inlet protection after every large storm event and at a minimum of once monthly.
< Remove sediment accumulated when it reaches 4-inches in depth.
< Replace filter fabric and clean or replace gravel if clogging is apparent.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

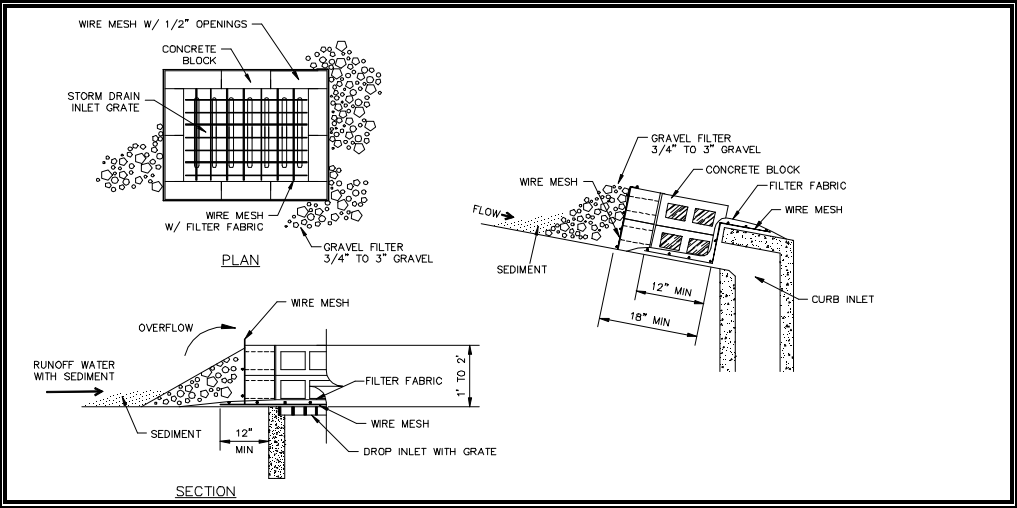
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP:Inlet Protection - Concrete Block

IP



DESCRIPTION:

Concrete block and gravel filter placed over inlet to storm drain system.

APPLICATION:

Construct at inlets in paved or unpaved areas where upgradient area is to be disturbed by construction activities.

INSTALLATION/APPLICATION CRITERIA:

< Place wire mesh (with ½ inch openings) over the inlet grate extending one foot past the grate in all directions.
< Place concrete blocks around the inlet with openings facing outward. Stack blocks to minimum height of 12-inches and maximum height of 24-inches.
< Place wire mesh around outside of blocks.
< Place gravel (3/4" to 3") around blocks.

LIMITATIONS:

< Recommended for maximum drainage area of one acre.
< Excess flows may bypass the inlet requiring down gradient controls.
< Ponding will occur at inlet.

MAINTENANCE:

< Inspect inlet protection after every large storm event and at a minimum of once monthly.
< Remove sediment accumulated when it reaches 4-inches in depth.
< Replace filter fabric and clean or replace gravel if clogging is apparent.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

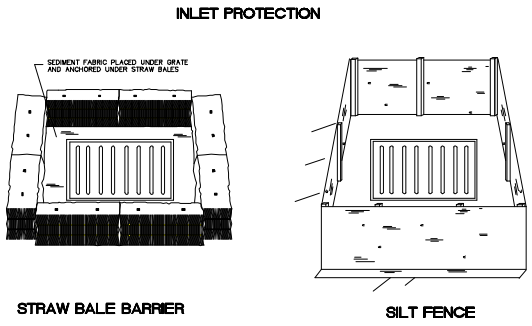
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Inlet Protection - Silt Fence or Straw Bale

IP



SEE INDIVIDUAL BMP INFORMATION SHEETS FOR INSTRUCTIONS FOR CONSTRUCTION OF STRAW BALE BARRIER AND SILT FENCE..

DESCRIPTION:

Sediment barrier erected around storm drain inlet.

APPLICATION:

Construct at storm drainage inlets located downgradient of areas to be disturbed by construction (for inlets in paved areas see other information sheets for inlet protection).

INSTALLATION/APPLICATION CRITERIA:

< Provide upgradient sediment controls, such as silt fence during construction of inlet.
< When construction of inlet is complete, erect straw bale barrier or silt fence surrounding perimeter of inlet. Follow instructions and guidelines on individual BMP information sheets for straw bale barrier and silt fence construction.

LIMITATIONS:

< Recommended maximum contributing drainage area of one acre.
< Limited to inlets located in open unpaved areas.
< Requires shallow slopes adjacent to inlet.

MAINTENANCE:

< Inspect inlet protection following storm event and at a minimum of once monthly.
< Remove accumulated sediment when it reaches 4-inches in depth.
< Repair or realign barrier/fence as needed.
< Look for bypassing or undercutting and recompact soil around barrier/fence as required.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

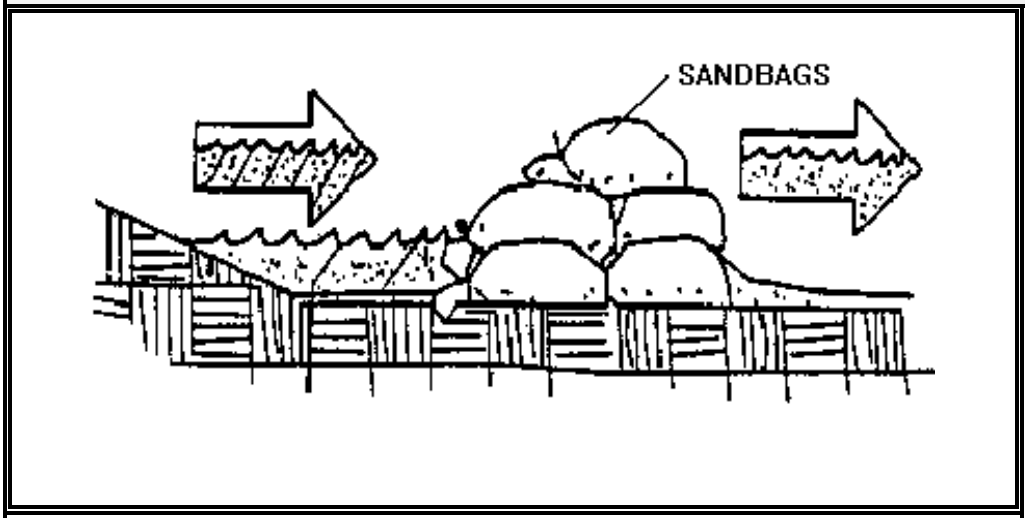
: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Sand Bag Barrier

SBB



DESCRIPTION:

Stacking sand bags along a level contour creates a barrier which detains sediment-laden water, ponding water upstream of the barrier and promoting sedimentation.

APPLICATION:

< Along the perimeter of the site.
< May be used in drainage areas up to 5 acres.
< Along streams and channels
< Across swales with small catchments.
< Around temporary spoil areas.
< Below the toe of a cleared slope.

INSTALLATION/APPLICATION CRITERIA:

< Install along a level contour.
< Base of sand bag barrier should be at least 48 inches wide.
< Height of sand bag barrier should be at least 18 inches high.
< 4 inch PVC pipe may be installed between the top layer of sand bags to drain large flood flows.
< Provide area behind barrier for runoff to pond and sediment to settle.
< Place below the toe of a slope.

LIMITATIONS:

< Sand bags are more expensive than other barriers, but also more durable.
< Burlap should not be used.

MAINTENANCE:

< Inspect after each rain.
< Reshape or replace damaged sand bags immediately.
< Replace sediment when it reaches six inches in depth.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
: Protect Slopes/Channels
: Control Site Perimeter
: Control Internal Erosion

West Valley City Stormwater Utility
West Valley City Engineering Division
3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

Stormwater Utility Credit Information: 801-963-3406
Stormwater Hotline: 801-963-3334
Stormwater Management Plan Review: 801-963-3318
Stormwater Permit: 801-963-3318

TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

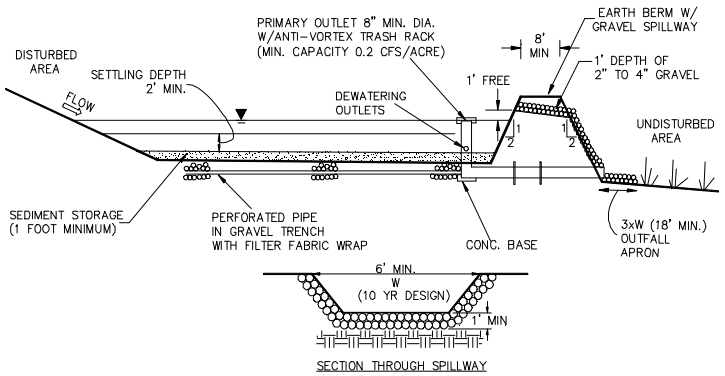
■ Capital Costs
9 O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Sediment Basin

SB



DESCRIPTION:

A pond created by excavation or construction of an embankment, and designed to retain or detain runoff sufficiently to allow excessive sediment to settle.

APPLICATION:

< At the outlet of all disturbed watersheds 10 acres or larger.
< At the outlet of smaller disturbed watersheds, as necessary.
< Where post construction detention basins will be located.

INSTALLATION/APPLICATION CRITERIA:

< Design basin for site specific location, maintain effective flow length 2 times width.
< Excavate basin or construct compacted berm containment, ensure no downgradient hazard if failure should occur. (Provide minimum of 67 cy. per acre of drainage area).
< Construct dewatering and outfall structure and emergency spillway with apron.

LIMITATIONS:

< Should be sized based on anticipated runoff, sediment loading and drainage area size.
< May require silt fence at outlet for entrapment of very fine silts and clays.
< May require safety fencing to prevent public access.
< Height restrictions for embankment regulated by Utah Division of Dam Safety.

MAINTENANCE:

< Inspect after each rainfall event and at a minimum of monthly.
< Repair any damage to berm, spillway or sidewalls.
< Remove accumulated sediment as it reaches 2/3 height of available storage.
< Check outlet for sedimentation/erosion of downgradient area and remediate as necessary. Install silt fence if sedimentation apparent.

OBJECTIVES

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9 Contain Waste
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9 Stabilize Disturbed Areas
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9 Low or Unknown Impact

■ Sediment
9 Nutrients
: Toxic Materials
9 Oil & Grease
: Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

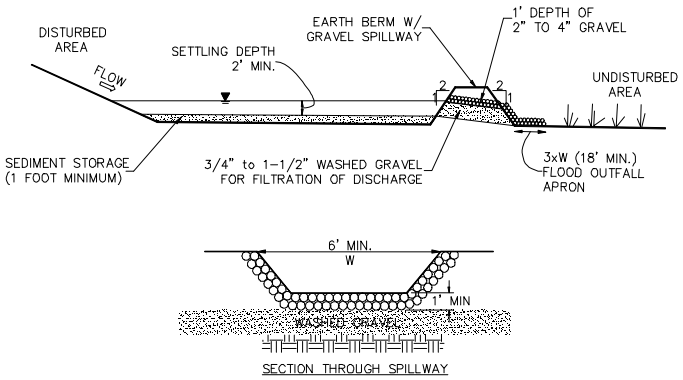
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Sediment Trap

ST



DESCRIPTION:

A sediment trap is a small excavated or bermed area where runoff from small drainage areas is detained and sediment can settle.

APPLICATION:

< Temporary control for runoff from disturbed areas of less than 3 acres.
< Temporary control for discharge from diversion dike, surface benching, or other temporary drainage measures.

INSTALLATION/APPLICATION CRITERIA:

< Design basin for site specific location.
< Excavate basin or construct compacted berm containment.
< Construct outfall spillway with apron.
< Provide downstream silt fence if necessary.

LIMITATIONS:

< Should be sized based on anticipated runoff, sediment loading and drainage area size.
< May require silt fence at outlet for entrapment of very fine silts and clays.

MAINTENANCE:

< Inspect after each rainfall event and at a minimum of monthly.
< Repair any damage to berm, spillway or sidewalls.
< Remove accumulated sediment as it reaches 2/3 height of available storage.
< Check outlet for sedimentation/erosion of downgradient area and remediate as necessary. Install silt fence if sedimentation apparent.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
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: Control Internal Erosion

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9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

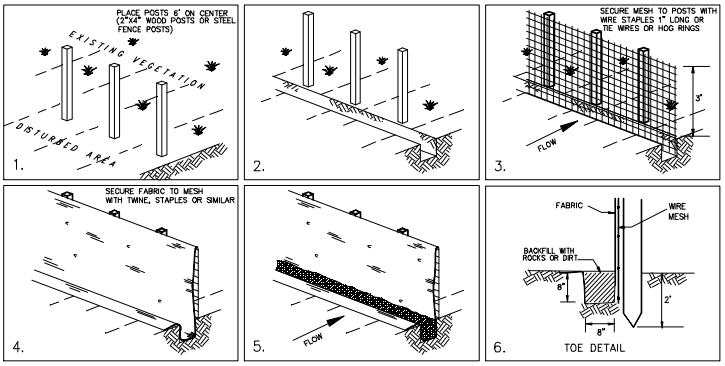
: Capital Costs
: O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

MATERIALS ADOPTED FROM SALT LAKE COUNTY ENGINEERING DIVISION GUIDANCE DOCUMENT

BMP: Silt Fence

SF



DESCRIPTION:

A temporary sediment barrier consisting of entrenched filter fabric stretched across and secured to supporting posts.

APPLICATION:

< Perimeter control: place barrier at downgradient limits of disturbance
< Sediment barrier: place barrier at toe of slope or soil stockpile
< Protection of existing waterways: place barrier at top of stream bank
< Inlet protection: place fence surrounding catchbasins

INSTALLATION/APPLICATION CRITERIA:

< Place posts 6 feet apart on center along contour (or use preassembled unit) and drive 2 feet minimum into ground. Excavate an anchor trench immediately upgradient of posts.
< Secure wire mesh (14 gage min. With 6 inch openings) to upslope side of posts. Attach with heavy duty 1 inch long wire staples, tie wires or hog rings.
< Cut fabric to required width, unroll along length of barrier and drape over barrier. Secure fabric to mesh with twine, staples, or similar, with trailing edge extending into anchor trench.
< Backfill trench over filter fabric to anchor.

LIMITATIONS:

< Recommended maximum drainage area of 0.5 acre per 100 feet of fence
< Recommended maximum upgradient slope length of 150 feet
< Recommended maximum uphill grade of 2:1 (50%)
< Recommended maximum flow rate of 0.5 cfs
< Ponding should not be allowed behind fence

MAINTENANCE:

< Inspect immediately after any rainfall and at least daily during prolonged rainfall.
< Look for runoff bypassing ends of barriers or undercutting barriers.
< Repair or replace damaged areas of the barrier and remove accumulated sediment.
< Reanchor fence as necessary to prevent shortcutting.
< Remove accumulated sediment when it reaches ½ the height of the fence.

Materials Adopted From Salt Lake County Engineering Division Guidance Document

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
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9 Floatable Materials
9 Other Waste

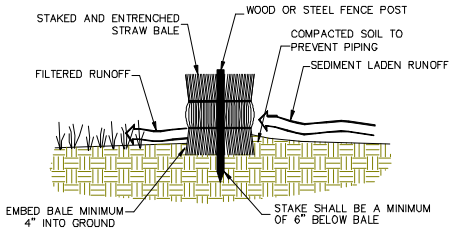
IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
: Maintenance
9 Training

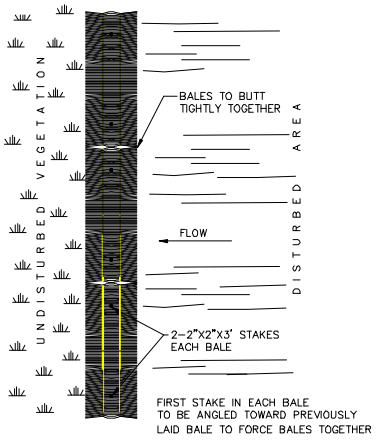
■ High **:** Medium **9** Low

BMP: Straw Bale Barrier

STB



SECTION



PLAN

DESCRIPTION:

Temporary sediment barrier consisting of a row of entrenched and anchored straw bales.

APPLICATION:

< Perimeter Control: place barrier at downgradient limits of disturbance.
< Sediment barrier: place barrier at toe of slope or soil stockpile.
< Protection of existing waterways: place barrier at top of stream bank.
< Inlet Protection.

INSTALLATION/APPLICATION CRITERIA:

< Excavate a 4-inch minimum deep trench along contour line, i.e. parallel to slope, removing all grass and other material that may allow underflow.
< Place bales in trench with ends tightly abutting, fill any gaps by wedging loose straw into openings.
< Anchor each bale with 2 stakes driven flush with the top of the bale.
< Backfill around bale and compact to prevent piping, backfill on uphill side to be built up 4-inches above ground at the barrier.

LIMITATIONS:

< Recommended maximum area of 0.5 acre per 100 feet of barrier
< Recommended maximum upgradient slope length of 150 feet
< Recommended maximum uphill grade of 2:1 (50%)

MAINTENANCE:

< Inspect immediately after any rainfall and at least daily during prolonged rainfall.
< Look for runoff bypassing ends of barriers or undercutting barriers.
< Repair or replace damaged areas of the barrier and remove accumulated sediment.
< Realign bales as necessary to provide continuous barrier and fill gaps.
< Recompact soil around barrier as necessary to prevent piping.

OBJECTIVES

9 Housekeeping Practices
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■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

: Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

CHAPTER 3

STORMWATER DISCHARGE MANAGEMENT FROM RESIDENTIAL ACTIVITIES

Pollutants of Concern
General Practices
References

Stormwater pollution from public activities is the contamination of our waterways that results from everyday public activities such as fertilizing the lawn, walking the dog, or changing motor oil. It is the combination of all public activities, not individual residence actions, that create an impact to creeks and streams. With each rainfall, pollutants generated by these activities are washed from streets and lawns into stormwater drains that flow into rivers and streams where they harm wildlife and fisheries and ruin recreation areas.

Unlike pollutants that come from a single-point source such as factories or sewage treatment plants, nonpoint source pollutants are washed by rainwater from streets, neighborhoods, farmlands, construction sites and parking lots. Because storm drains are separated from our household sewer systems, these polluted waters flow directly into rivers and streams without treatment.

Each of us, whether we know it or not, contributes to nonpoint source pollution through our daily activities. As a small, individual activity conducted by everyone within the valley, the effect is multiplied. As a result, nonpoint source pollution is the BIGGEST threat to many of our ponds, creeks, rivers, and lakes.

POLLUTANTS OF CONCERN

Consider what happens to detergents from washing your car, leaves and lawn clippings left in the gutter, or litter that is carelessly deposited alongside of the road. These are the kinds of pollutants that flow into the storm drain system. Below is a brief description of some of the more typical stormwater pollutants and potential impacts these pollutants may have on waterways.

Sediment

Sediment can be harmful to aquatic life (plants, fish, and other animals that live in lakes and streams). Light needed by plants in water is blocked by sediments. Sediments can carry chemicals that are toxic and that cause the oxygen in water to be used up. Sediments clog fish gills and fill in the places they hide. Sediment generally is the result of soil erosion from lawns, hillsides, and gardening/landscaping activities.

Floatables

Floatables are pieces of litter in the water. They may be contaminated with toxic chemicals and bacteria. Floatables are also an eyesore in our waterways. Commonly observed floatables include cigarettes, plastic containers, wrappers, and cans. Floatables such as these are generally the result of careless handling practices or littering.

Bacteria and Viruses

Bacteria is washed with animal excrement and leakage from sewers and septic tanks into waterways. These organisms can cause disease in both animals and humans. Biological contaminants come from litter, organic matter, and animal waste.

Oxygen Demanding Substances

The chemical breakdown of organic materials (leaves, excrement and street litter) washed into waterways decreases levels of dissolved oxygen in water. Aquatic life requires this oxygen to exist.

Nutrients

Nutrients such as nitrogen and phosphorus result in excessive plant growth that clogs waterways, blocks sunlight, and reduces oxygen. Some sources of nutrients are fertilizer, excrement, and detergents.

Oil and Grease

Petroleum products (gasoline, oil, and grease) may be toxic to aquatic life, even in small amounts. Oil and grease in storm drains can generally be traced to automotive leaks and spills or improper disposal of used oil and automotive products into storm drains.

Pesticides, Herbicides and Fertilizers

Excess amounts of pesticides, herbicides, and fertilizers applied to yards, lawns and greenways are washed into streams during rainfall events. These chemicals can cause increased algae growth and toxicity to organisms.

Metals

Metals such as lead, zinc, mercury, copper, and cadmium in water, can be toxic to humans, aquatic life and other animals that drink the water. Metals come from vehicle exhaust, weathered paint, metal plating, tires and motor oil.

Toxic Substances

Gasoline, household products, and paint thinner are examples of toxic substances. These substances can deplete oxygen in waterways and cause toxic effects in living organisms.

GENERAL PRACTICES

As citizens, there are many things that we can do to protect the water in our environment. These general practices can be executed by simpler changes to routine habits. With every resident practicing good housekeeping and material management, great effects can be seen in local water quality. Here are just a few:

Household and Home Maintenance

- Buy household products such as cleaners and furniture polish labeled "non-toxic". Use small quantities and purchase only the amount you need.
- Follow manufacturer's recommendations for use and storage of all toxic products, including cleaners, solvents, and paints.
- Properly dispose of household hazardous wastes (any toxic substances) at solid waste facilities.
- Rinse paint brushes in the sink. Filter and reuse paint thinner or brush cleaners. Dispose of used materials at a hazardous materials collection event.
- Recycle reusable materials. Throw litter into trash cans and keep cans tightly covered to prevent foraging by neighborhood animals.

Lawn and Garden

- Minimize the use of pesticides, herbicides and fertilizers; apply carefully and sweep up excess.
- Use a broom rather than a hose to clean up sidewalks and driveways. Do not hose down gutter.
- Deposit leaves and clippings in a garbage can or a compost pile.
- Divert rain spouts and garden hoses from paved surfaces onto grass or garden areas to allow filtration through the soil. Water only your lawn and garden.
- Control sediment migration and erosion, don't let it reach the gutter, sweep up and re-use it.
- Do not over-water -- Don't be a "gutterflooder."
- Pick-up, bag, and dispose of pet waste in a garbage can.

Automotive

- Recycle used motor oil and antifreeze at automotive centers.
- Have your car inspected and maintained regularly to reduce leakage of oil, antifreeze and other fluids.
- Reduce automotive emissions through regular auto maintenance, ride sharing, and by using

public transportation.

- Conserve water when washing your car and use biodegradable soap.

Non-point source pollution comes from many sources and its control is everyone's responsibility. Pollution prevention and good housekeeping practices are essential to reducing non-point source pollution. From the individual gardener to the public official, everyone has a stake in protecting our resources. The best place to get started is your own backyard and garage.

Current programs established to assist to assist with disposal of household chemicals include:

Used Motor Oil

The following facilities accept used motor oil from residents. Auto Zone Stores, Checkers, Jiffy Lube, NAPA Auto Parts, Pep Boys Stores, and Q Lube Services. This list is not an endorsement by Salt Lake County of any particular company.

Household Hazardous Waste Facility

This specialized program accepts household hazardous wastes from Salt Lake County residents free of charge. Household hazardous wastes include paints, thinners, batteries, insecticides, anti-freeze, fuels and cleaning solvents.

Salt Lake Solid Waste Landfill
Monday through Saturday, 8 a.m. - 4 p.m.
6030 West 1300 South
(801) 313-6700

Trans Jordan Cities Landfill (Fall 1999)
Monday through Saturday, 8 a.m. - 6 p.m.
10873 South 7200 West
(801) 569-8994

REFERENCES

Orange County Environmental Management Agency. "The ocean begins at your front door! Nonpoint Source Pollution and what you can do to help!"

New Jersey Department of Environmental Protection and Energy. "Nonpoint Source Pollution."

CHAPTER 4

STORMWATER DISCHARGE MANAGEMENT FROM MUNICIPAL ACTIVITIES

Pollutants of Concern
Selection of Best Management Practices
References
BMP Information Sheets

This chapter is designed to assist municipalities in developing and implementing Best Management Practices (BMP's) for stormwater quality management. The primary users include engineers, planners, and environmental specialists responsible for selecting BMPs as part of a municipal stormwater management program. In addition, consulting engineers and developers will find the information provided in this chapter to be helpful in their work.

This chapter is organized into three sections. The first section discusses pollutants of concern on stormwater discharges associated with urban/municipal activities. The second section provides guidance in developing and implementing best management practices (BMPs) for pollutant control. The final section provides a brief summary of the stormwater programs and permits currently required.

POLLUTANTS OF CONCERN

A variety of pollutants are associated with stormwater pollution due to municipal activities including: sediment, nutrients, bacteria and viruses, oxygen demanding substances, oil and grease, metals, toxic pollutants, and floatables (Table 4-1). The impacts of these pollutants on water quality along with a discussion on municipal activities which can potentially contribute to their introduction into stormwater runoff is presented in the following subsections.

Sediment

Sediment is a common component of stormwater, and is considered to be one of the most damaging pollutants in Utah. Sediment fills in streams, lakes, rivers, wetlands, and road ditches, and can affect aquatic life by smothering fish larvae and eggs. Suspended soil particles can cause water to look cloudy or turbid. Excessive turbidity reduces light penetration in water, impairs sight of feeding fish, clogs fish gills, and increases drinking water treatment costs. Fine sediment also acts as a vehicle to transport other pollutants including nutrients, trace metals, and hydrocarbons to nearby surface waters.

Significant sediment-borne pollutants are associated with highway runoff; originating from pavement wear, vehicles, atmospheric deposition, and road maintenance. Other sources of sediment include erosion from new development and construction sites.

Nutrients

Nutrients, especially nitrogen and phosphorus, can cause algal blooms and excessive aquatic plant growth in lakes. These conditions can impair many important uses of these waters, including recreation, fish habitat, and water supply.

Nitrogen and phosphorus associated with highway runoff come from atmospheric deposition and roadside fertilizer application. Phosphorus has also been associated with application of sand and salt on roads. Nutrients are a result of yard debris, garbage, as well as fertilizer and pesticide use.

Metals

Trace metals are a water quality concern because the toxic effects they can have on aquatic life. Metals can also be a health hazard to humans through direct ingestion of contaminated water or through eating contaminated fish. The most common trace metals found in stormwater runoff in urban areas are lead, zinc, and copper. These metals originate from galvanizing, chrome plating, and other metal sources associated with automobiles. Lead, cadmium, nickel and zinc in urban runoff have also been associated with different sources including body rust, brake lining wear, steel highway structures, and tire wear from automobiles.

Oxygen-demanding substances

Oxygen-demanding substances tend to deplete the dissolved oxygen levels in streams and lakes. The depleted oxygen supply can result in the reduction of aquatic life. Oxygen demanding substances are found in yard waste (such as leaves and lawn clippings), animal wastes, street litter, and organic matter.

Bacteria and Viruses

Bacteria and viruses are the most common microorganisms found in surface water runoff. Bacteria and viruses often carry diseases which can be transferred to animal life and to humans. The main sources of these contaminants are animal excrement and sanitary sewer overflows.

Oil, Grease and Hydrocarbons

Oil, grease and hydrocarbons contain a wide array of compounds, some of which are toxic to aquatic organisms at low concentrations. The main sources of oil and grease are leakage from engines, restaurant grease traps, and waste oil disposal. Hydrocarbons typically come from spills, leaks, lubricants and asphalt surface leachate. Hydrocarbon levels are highest from parking lots, roads and service stations.

Floatables

Floatables are pollutants that may be contaminated with heavy metals, pesticides, and bacteria. Typically resulting from street refuse or industrial yard waste, floatables also create an aesthetic "eye sore" in waterways or detention basins.

Table 4-1. Potential pollutants of concern associated with municipal activities.

Activity	Pollutant	Potential Source
Construction	Sediment	Poor erosion control practices on hillsides, undeveloped property, right-of-way for construction sites
Residential, Parks, and Golf Courses	Nutrients	Yard debris, garbage, fertilizer and pesticide use, rat poison, pyrotechnics
Transportation and Commercial	Metals	Paint, plastics, pottery pigments and glazes, automobile tires, common galvanized coatings, pesticide use, root killer application on sewer lines, old lead paint and glazes, wood preservatives, batteries
Residential	Oxygen Demanding Substances	Yard debris, animal wastes, organic chemical use
Parks and Residential	Bacteria and Viruses	Human and animal (pets and aquatic life) waste, sanitary sewer infiltration into storm drain system, decomposing yard waste
Commercial and Residential	Oil, Grease, and Hydrocarbons	Asphalt surface leaching, spills, leaks, construction activities
Residential and Parks	Floatables	Street refuse, industrial yard waste

BEST MANAGEMENT PRACTICES

Federal and State regulations require municipalities to develop and implement best management practices (BMPs) for inclusion into stormwater management programs. This section is designed to provide guidance in the selection of these BMPs.

BMP SELECTION

There is no one specific BMP that will solve all pollution problems as a result of stormwater runoff. Rather problems should be addressed on a case-by-case or pollutant specific basis. Often the preferred method will involve a combination of BMPs.

One method often used to select the most suitable BMPs for implementation is the matrix comparison method. In this method, a table is constructed with various BMPs along the horizontal axis and evaluation criteria along the vertical axis. A numeric rating or a simple + or - rating can be used. Table 4-2 lists several evaluation criteria commonly used in many locations as a guideline for BMP program development. The municipality may wish to total an actual score and use the results to rank potential BMPs, or simply use Table 4-2 as a way to judge BMP strengths or potential problems. Not all criteria apply to each BMP.

MONITORING BMP PERFORMANCE

Routine monitoring of Best Management Practices is essential to maintain optimal performance, although often difficult and expensive. The assessment consists of two basic methods: water quality monitoring and non-conventional monitoring.

Water Quality Monitoring

A monitoring program is required by the Salt Lake County UPDES permit to verify the presence or absence of pollutants in the stormwater. The program collects composite stormwater samples during stormwater runoff events. In this manner, pollutant loading and trend analysis can be completed.

Non-conventional monitoring

Non-conventional monitoring uses indirect methods to measure water quality and BMP performance. These methods, generally applied where source control BMPs are implemented, provide data on pollutant reduction as opposed to water quality data gathered by conventional monitoring.

Although these methods do not measure receiving water directly, they do eliminate many of the variables and uncertainties associated with monitoring. Listed below are several non-conventional methods that may be used to establish BMP effectiveness.

Public surveys - Effective implementation depends on a clear sense of the public's awareness of the problem, the most effective means for increasing their understanding, and their willingness to participate in the solutions.

New Ordinances/Programs - Although the establishment of new programs and ordinances does not mean that the Storm Water Pollution Prevention Plan or individual BMPs are effective, it does mean that within the municipality, the problems have been identified, decision makers have been educated and are supportive, goals have been set, budgets have been modified, and resources have been allocated.

Level of participation - Level of participation by the general public and business can provide a direct measure of effectiveness. Participation indicates an understanding of the problem and a willingness of the participant to share in the solution.

Record Keeping/Program Tracking - This is the municipal employee equivalent of the level of participation method for the general public and businesses. This is an important aspect of most municipal source controls.

Table 4-2. Best Management Practice Screening Criteria

BMPs:				
Criteria Description	+ / 0 / -	+ / 0 / -	+ / 0 / -	Comments
1. Human Risk, Public Safety and Potential Liability				
2. Environmental Risk and Implications				
3. Ability to Control Key Targeted Pollutants				
4. Cost to Implement and Continuing Costs				
5. Acceptability to Public, Stakeholders, Staff, Political				
6. Equitability to Impacted Persons				
7. Reliability and Consistency over Time				
8. Sustainability of Maintenance or Program Management				
9. Ability to be Applied Universally Throughout the Municipality, or, on a Specified Watershed				
10. "Fit" with other Operations and Programs				
11. Relationship To Federal, State, or Local Regulatory Requirements				
12. Amenity or Multi-use Value				
Totals				

The following is a discussion of the items included in Table 4-2.

1. Human Risk, Public Safety and Potential Liability. Some BMPs carry with them some inherent risk as well as value. Risk must be assessed even informally to limit potential human risk and liability.
2. Environmental Risk and Implications. Some BMPs carry very little human risk but may carry a high environmental risk. If the risk of BMP failure is high the use of the BMP may need to be avoided or modified.
3. Ability to Control Key Targeted Pollutants. The BMP should be able to reduce targeted pollutants to acceptable levels.
4. Cost to Implement and Continuing Costs. The total cost of each BMP including implementation and maintenance should be scrutinized.
5. Acceptability to the Public, Stakeholders, Staff and Political Leadership. Certain BMPs may be less acceptable to certain people or for certain uses.
6. Equitability to Impacted Persons. The level of inconvenience to impacted persons must be weighed against the public good.
7. Reliability and Consistency over Time. Reliability refers to the ability of the BMP to continue over a long period of time without failing. Consistency refers to its ability to reproduce its mitigation ability over time.
8. Sustainability in Terms of Maintenance or Program Management. If the BMP cannot be assured, reasons for non-assurance should be eliminated or other BMP alternatives should be sought.
9. Ability to be Applied Universally Throughout the Municipality, or, on a Specific Watershed Basis. While the use of certain BMPs may be appropriate in only some areas, it is desirable to be able to use them wherever necessary.
10. "Fit" with other Operations and Programs. BMPs have a better prospect for success if existing programs can be simply modified to incorporate stormwater quality objectives.
11. Relationship to other Federal, State, or Local Regulatory Requirements. It is advantageous if a BMP fits within and does not violate the regulatory requirements.
12. Amenity or Multi-Use Value. BMPs should support each other and fit into community objectives.

USING MONITORING DATA

All of these methods may be used to document the municipality's efforts and to provide information for:

- Program planning;
- Cost-effectiveness determinations for program evaluation and modification;
- Reporting requirements; and
- Establishing that pollutants are being reduced to the "maximum extent practicable" as required by the regulations.

STORMWATER PROGRAMS

The principal regulating vehicles to control stormwater discharges is the Federal Clean Water Act, as amended in 1987 and the Utah Water Quality regulations. Stormwater programs take place at the Federal, State and local levels. Below is a summary of the various programs to control stormwater discharges. These are relatively new programs and can be expected to evolve over the next few years.

FEDERAL PROGRAMS

The 1987 amendment to the Clean Water Act established the framework for regulating municipal, industrial and construction stormwater discharges under the NPDES program.

STATE PROGRAM

The State Water Quality Act requires municipal, industrial and construction permits for stormwater discharges. Currently, unincorporated Salt Lake County, UDOT and Salt Lake City have municipal stormwater discharge permits under Phase I. Phase II regulations due out October 1999 will require municipal permits from approximately 60 cities, towns and counties in Utah. Municipal permits requires the development and implementation of Stormwater Management Plans.

Certain industrial facilities are required to prevent stormwater pollutions. Regulated facilities include manufacturing waste handling and disposal, trucking and shipping and many other industries based on classification codes. If the facility is regulated, a permit and a Stormwater Pollution Prevention Plan are required.

Construction sites greater than 5 acres are currently regulated. These sites need a permit to discharge stormwater and a Stormwater Pollution Prevention Plan.

Local erosion and control permits may be required by the local regulating agency. These permits vary in requirements and should be verified with local authorities.

REFERENCES

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USE OF SOURCE CONTROL BMP INFORMATION SHEETS

Attached are specific source control BMP information sheets for common municipal activities that may pollute stormwater. The list is not exhaustive and variations are acceptable provided implemented controls meet regulatory requirements.

Each information sheet is organized into three main sections:

- Heading
- Main Body
- Side Bar

HEADING

In addition to the title of the BMP, a 2 to 4 letter abbreviation of the BMP is provided in the upper right-hand corner. The abbreviation may be used for identifying the selected BMP on the Storm Water Pollution Prevention Plan (SWPPP) Site Map. The information sheet for the selected BMP can then be attached to the SWPPP to provide details regarding purpose, installation, and maintenance.

MAIN BODY

The main body in each BMP sheet contains the following information:

- Example illustration of the BMP;
- description of the BMP;
- approach;
- limitations; and
- maintenance (where necessary).

SIDE BAR

The side bar presents information on the program elements where this BMP applies, targeted constituents, and an indication of the level of effort and cost to implement.

Program Elements:
New Development
Residential
Commercial Activities
Industrial Activities
Municipal Activities
Illegal Discharges

Targeted Pollutants:
Sediment
Nutrients
Heavy Metals
Toxic Materials
Floatable Materials
Oxygen Demanding Substances
Oil & Grease
Bacteria & Viruses

Each information sheet provides an indication of whether the BMP will have a high, medium, or low/unknown impact on removing these constituents.

Implementation Requirements:
Costs:
- Capital Costs
- O&M Costs

Level of effort associated with:
- Regulatory
- Staffing
- Training
- Administrative

Each information sheet indicates the relative cost or level of effort (high, medium, low) to implement the BMP.

DECISION MATRIX

The source control BMPs for municipal activities are listed in the decision matrix on the following page. The matrix is provided to give the user a relatively easy way to identify applicable BMPs. The user should understand that the matrix is only a guide and should not be used in place of sound engineering judgement.

To use the matrix, identify the program elements which apply for the particular activity (going horizontally across the top of the sheet). Once identified, select the BMPs (running vertically along the left side of the sheet) which can be used with the particular program element.

USE OF TREATMENT CONTROL BMP INFORMATION SHEETS

Attached are specific treatment control Best Management Practices (BMPs) for common municipal activities that may pollute stormwater. The list is not exhaustive and variations are acceptable provided implemented controls meet regulatory requirements.

Each information sheet is organized into three main sections:

- Heading
- Main Body
- Side Bar

HEADING

In addition to the title of the BMP, a 2 to 4 letter abbreviation of the BMP is provided in the upper right-hand corner. The abbreviation may be used for identifying the selected BMP on the Storm Water Pollution Prevention Plan (SWPPP) Site Map. The information sheet for the selected BMP can then be attached to the SWPPP to provide details regarding purpose, installation, and maintenance.

MAIN BODY

The main body in each BMP sheet contains the following information:

- Example illustration of the BMP;
- description of the BMP;
- applications;
- installation/application criteria
- maintenance; and
- limitations.

SIDE BAR

The side bar presents information on where the BMP applies, targeted constituents, and an indication of the level of effort and cost to implement.

Considerations:

Soils - Is the BMP dependent on soil type and condition?

Area Required - Does the BMP require considerable space?

Slope - Can the BMP be placed on or near steep slopes?

Water Availability - Does the BMP require water during dry seasons?

Aesthetics - Will the BMP be visible to the public so that it must be aesthetically pleasing?

Hydraulic Head - Does the BMP require a drop in water elevation to work properly?

Environmental Side Effects - Does the BMP have negative effects (e.g. undesirable insects) or positive effects (e.g. wildlife habitat, recreation)?

Targeted Pollutants:

Sediment
Nutrients
Heavy Metals
Toxic Materials
Floatable Materials
Oxygen Demanding Substances
Oil & Grease
Bacteria & Viruses

Each information sheet provides an indication of whether the BMP will have a high, medium, or low/unknown impact on removing these constituents.

Implementation Requirements:

Costs:
- Capital Costs
- O&M Costs

Level of effort associated with:
- Maintenance
- Training

Each information sheet indicates the relative cost or level of effort (high, medium, low) to implement the BMP.

DECISION MATRIX

The treatment control BMPs for municipal activities are listed in the decision matrix at the beginning of the BMP section. The matrix is provided to give the user a relatively easy way to identify applicable BMPs. The user should understand that the matrix is only a guide and should not be used in place of sound engineering judgement.

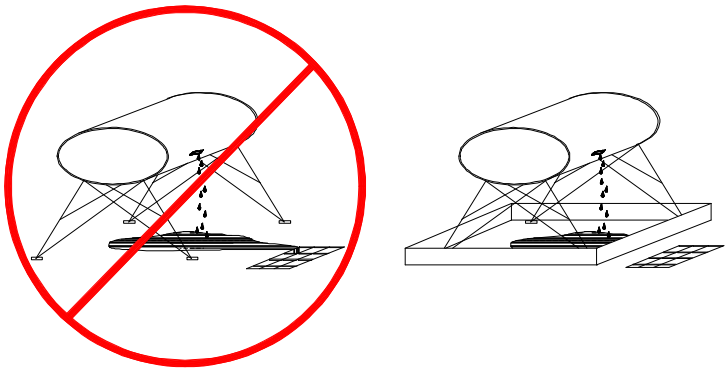
Municipal BMPs

		Program Elements			
Source Control BMPs to Consider		New Development	Residential	Commercial Activities	Industrial Activities
ATL	Aboveground Tank Leak and Spill Control			X	X
BGM	Buildings and Grounds Maintenance			X	X
BRRC	Building Repair, Remodeling, and Construction			X	X
CBC	Catch Basin Cleaning				
CESA	Contaminated or Erodible Surface Areas	X		X	X
DIDM	Detention/Infiltration Device Maintenance				
ET	Employee Training	X	X	X	X
HWM	Hazardous Waste Management	X	X	X	X
HP	Housekeeping Practices		X		
IDC	Illegal Dumping Controls				
LUPM	Land Use Planning/Management	X			
LSSC	Leaking Sanitary Sewer Control		X	X	X
LC	Litter Control	X	X	X	X
PEP	Public Education/Participation		X	X	
RBM	Roadway/Bridge Maintenance				
SCCM	Storm Channel/Creek Maintenance	X			
SDF	Storm Drain Flushing				
SDSS	Storm Drain System Signs	X	X	X	X
SC	Street Cleaning				
VUR	Vehicle Use Reduction	X	X		

		BMP Criteria			
Treatment Control BMPs to Consider		Soils	Area Required	Slope	Water Availability
BF	Biofilters	X	X	X	X
CM	Chemical Mulch	X		X	
CW	Constructed Wetlands	X	X	X	X
DTSF	Double Trench Sand Filter	X		X	
EDB	Extended Detention Basins		X		
FS	Floatable Skimmers				X
IN	Infiltration	X	X	X	
LS	Level Spreaders	X	X	X	
MF	Media Filtration				
DCIA	Minimizing DCIAs			X	
OWS	Oil/Water Separators and Water Quality Inlets		X		
PSFS	Peat-Sand Filter System	X		X	
RR	Riprap	X	X	X	
SSFS	Surface Sand Filter System	X		X	
TSFS	Trench Sand Filter System	X		X	
WP	Wet Ponds	X	X	X	X

BMP: Aboveground Tank Leak And Spill Control

ATL



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from aboveground storage tanks by installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

The most common causes of unintentional releases are:

< Installation problems,
< Failure of piping systems (pipes, pumps, couplings, hoses, and valves),
< External corrosion and structural failure,
< Spills and overfills due to operator error, and
< Leaks during pumping of liquids or gases from a truck to a storage tank or vice versa.

APPROACH:

< Integrate efforts with existing aboveground petroleum storage tank programs through the local Fire Department and Health Department, and area and business emergency response plans through the City, County, or Fire District.
< Use engineering safeguards to reduce the chance for spills.
< Perform regular maintenance.

LIMITATIONS:

For larger spills, a private spill clean-up company or Hazmat team may be necessary.

MAINTENANCE:

Maintenance is critical to preventing leaks and spills. Conduct routine weekly inspections and:

< Check for external corrosion and structural failure,
< Check for spills and overfills due to operator error,
< Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves),
< Check for leaks or spills during pumping of liquids or gases from truck to storage facility or vice versa.
< Periodically, integrity testing should be conducted by a qualified professional.

PROGRAM ELEMENTS

9 New Development
9 Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
: Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
9 Heavy Metals
■ Toxic Materials
9 Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

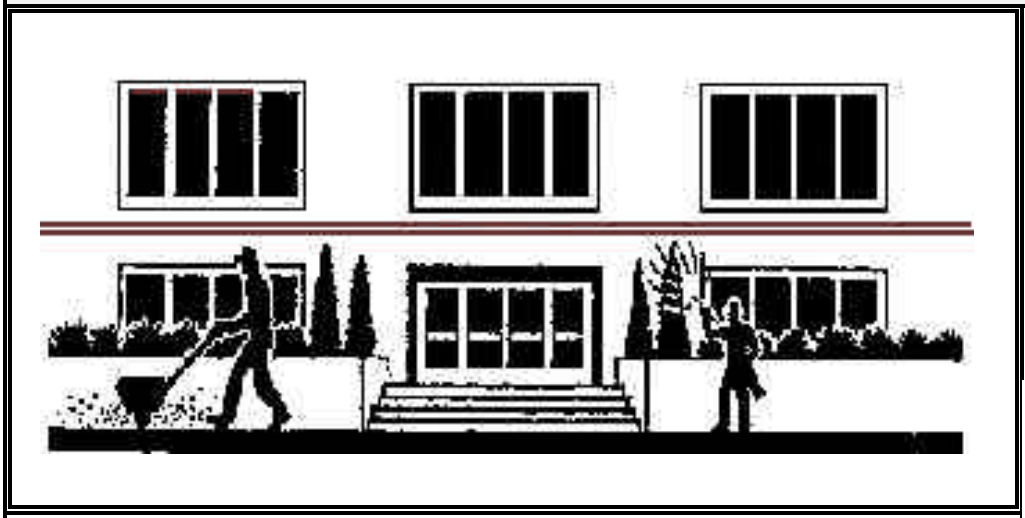
: Capital Costs
9 O&M Costs
: Regulatory
■ Training
: Staffing
: Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Buildings And Grounds Maintenance

BGM



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from buildings and grounds maintenance by washing and cleaning up with as little water as possible, preventing and cleaning up spills immediately, and maintaining the stormwater collection system.

APPROACH:

- < Preserve existing native vegetation to reduce water, fertilizer, and pesticide needs.
- < Carefully use pesticides and fertilizers in landscaping.
- < Take care in over-watering landscape sites to reduce the risk of discharge of water contaminated with nutrients and pesticides.
- < Integrate pest management where appropriate.
- < Sweep paved surfaces.
- < Clean the storm drainage system at appropriated intervals, includes marking storm drain inlets to minimize the dumping of inadvertent liquids.
- < Properly dispose wash water, sweepings, and sediments.
- < Take care of landscaped areas around the facility.
- < Clean parking lots and areas other than industrial activity.
- < Clean all catch basins in parking lots every 6 to 12 months or whenever the sump is full.
- < Sweeping, either vacuum or mechanical, is the most appropriate BMP for cleaning parking lots and basins.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable or effective in every case.

MAINTENANCE:

The BMPs themselves relate to maintenance and do not require maintenance as they do not involve structures.

PROGRAM ELEMENTS

9 New Development
9 Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
9 Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

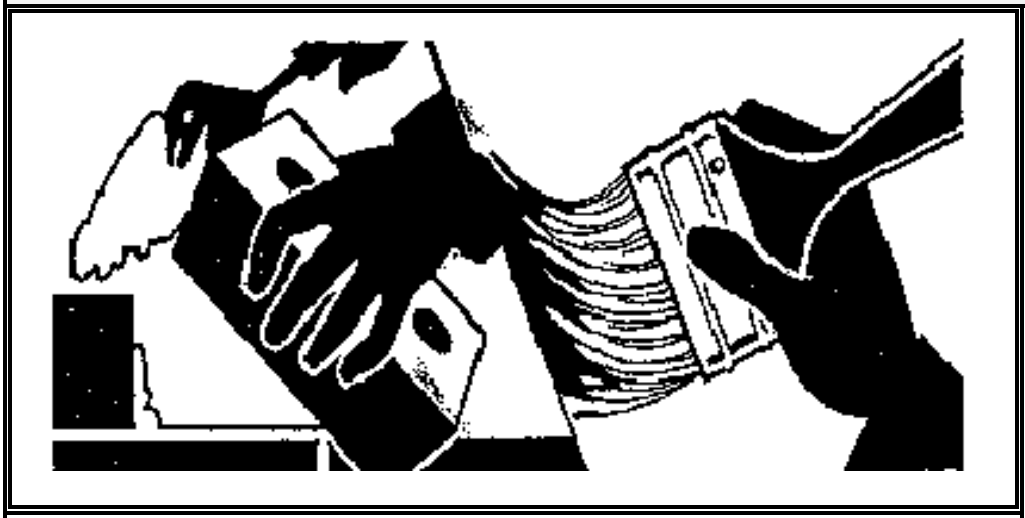
9 Capital Costs
: O&M Costs
9 Regulatory
: Training
: Staffing
: Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Building Repair, Remodeling, and Construction

BRRC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from building repair, remodeling and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

APPLICATION:

< Use soil erosion control techniques if bare ground is temporarily exposed.
< Use permanent soil erosion control techniques if the remodeling clears buildings from an area that are not to be replaced.

INSTALLATION/APPLICATION CRITERIA:

< Enclose painting operations consistent with local air quality regulations and OSHA.
< Properly store materials that are normally used in repair and remodeling such as paints and solvents.
< Properly store and dispose waste materials generated from the activity.
< Maintain good housekeeping practices while work is underway.

LIMITATIONS:

< This BMP is for minor construction only.
< Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.
< Safer alternative products may not be available, suitable, or effective in every case.
< Be certain that actions to help storm water quality are consistent with OSHA and air quality regulations.

MAINTENANCE:

None.

OBJECTIVES

: Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
9 Stabilize Disturbed Areas
9 Protect Slopes/Channels
9 Control Site Perimeter
9 Control Internal Erosion

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ENGINEERING DIVISION
MANAGING THE FUTURE

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

Sediment
9 Nutrients
■ Toxic Materials
■ Oil & Grease
■ Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

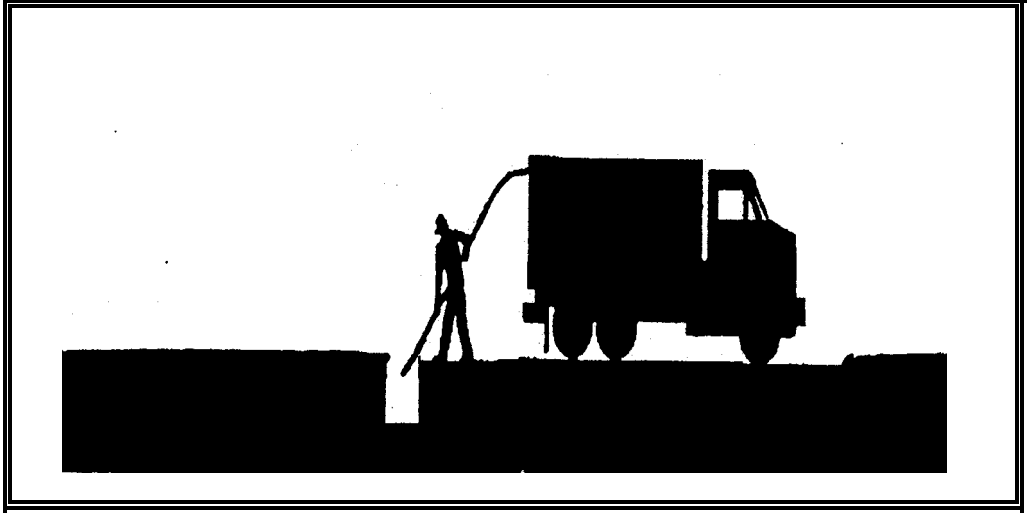
9 Capital Costs
: O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adapted From Salt Lake County Engineering Division Guidance Document

BMP: Catch Basin Cleaning

CBC



DESCRIPTION:

Maintain catch basin and stormwater inlets on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, and restore the catch basins' sediment trapping capacity. A catch basin is distinguished from a stormwater inlet by having at its base a sediment sump designed to catch and retain sediments below the overflow point. This information sheet focuses on the cleaning of accumulated sediments from catch basins.

APPROACH:

Regular maintenance of catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants. In general, the key to effective catch basins are:

< At least annual inspections.
< Prioritize maintenance to clean catch basins and inlets in areas with the highest pollutant loading.
< Clean catch basins in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.
< Keep accurate logs of the number of catch basins cleaned.
< Record the amount of waste collected.

LIMITATIONS:

There are no major limitations to this best management practice.

MAINTENANCE:

Regular maintenance of public and private catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants. In general, the keys to effective catch basins are:

< Annual/monthly inspection of public and private facilities to ensure structural integrity, a clean sump, and a stenciling of catch basins and inlets.
< Keep logs of the number of catch basins cleaned.
< Record the amount of waste collected.

PROGRAM ELEMENTS

9 New Development
9 Residential
9 Commercial Activities
9 Industrial Activities
: Municipal Facilities
: Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
■ Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
■ O&M Costs
9 Regulatory
: Training
■ Staffing
: Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Contaminated or Erodible Surface Areas

CESA

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from contaminated or erodible surface areas by leaving as much vegetation on-site as possible, minimizing soil exposure time, stabilizing exposed soils, and preventing stormwater runon and runoff.

APPROACH:

This BMP addresses soils which are not so contaminated as to exceed criteria but the soil is eroding and carrying pollutants off in the stormwater.

Contaminated or erodible surface areas can be controlled by:

< Preservation of natural vegetation,
< Re-vegetation,
< Chemical stabilization,
< Removal of contaminated soils, or
< Geosynthetics.

LIMITATIONS:

Disadvantages of preserving natural vegetation or re-vegetating include:

< Requires substantial planning to preserve and maintain the existing vegetation.
< May not be cost-effective with high land costs.
< Lack of rainfall and/or poor soils may limit the success of re-vegetated areas.

Disadvantages of chemical stabilization include:

< Creation of impervious surfaces.
< May cause harmful effects on water quality.
< Is usually more expensive than vegetative cover.

MAINTENANCE:

Maintenance should be minimal, except if irrigation of vegetation is necessary.

PROGRAM ELEMENTS

: New Development
9 Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
9 Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
: Heavy Metals
■ Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

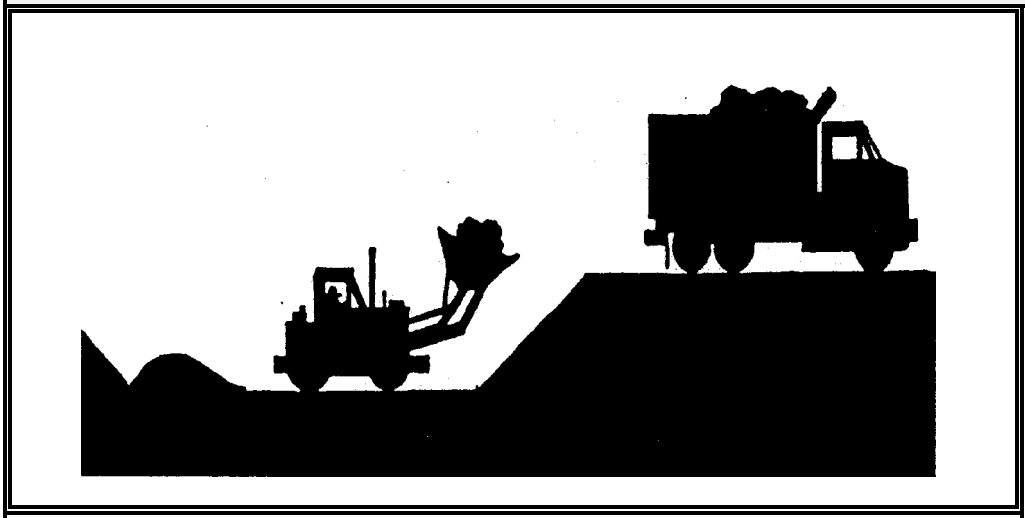
■ Capital Costs
: O&M Costs
9 Regulatory
9 Training
: Staffing
: Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Detention/Infiltration Device Maintenance

DIDM



DESCRIPTION:

Proper maintenance and siltation removal is required on both a routine and corrective basis to promote effective stormwater pollutant removal efficiencies for wet/dry detention pond and infiltrative devices.

APPROACH:

< Remove silt after sufficient accumulation.
< Periodically clean accumulated sediment and silt out of pre-treatment inlets.
< Infiltration device silt removal should occur when the infiltration rate drops below ½ inch per hour.
< Removal of accumulated paper, trash, and debris should occur every six months or as needed to prevent clogging of control devices.
< Vegetation growth should not be allowed to exceed 18 inches in height.
< Mow the slopes periodically and check for clogging, erosion and tree growth on the embankment.
< Corrective maintenance may require more frequent attention (as required).
< Create a public education campaign to explain the function of wet/dry detention pond/infiltration devices and their operation requirements for proper effectiveness.
< Encourage the public to report wet/dry detention pond/infilitration devices needing maintenance.

LIMITATIONS:

< Wet detention pond dredging can produce slurried waste that often exceeds the requirements of many landfills.
< Frequent sediment removal is labor and cost intensive.

PROGRAM ELEMENTS

9 New Development
9 Residential
9 Commercial Activities
9 Industrial Activities
: Municipal Facilities
9 Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
■ Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
■ O&M Costs
9 Regulatory
9 Training
: Staffing
9 Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Employee Training

ET

DESCRIPTION:

Employee training, like equipment maintenance, is a method by which to implement BMPs. Employee training should be used in conjunction with all other BMPs as part of the facility's SWPPP.

The specific employee training aspects of each of the source controls are highlighted in the individual information sheets. The focus of this information sheet is more general, and includes the overall objectives and approach for assuring employee training in stormwater pollution prevention. Accordingly, the organization of this information sheet differs somewhat from the other information sheets in this chapter.

OBJECTIVES:

Employee training should be based on four objectives:

< Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater;
< Identify solutions (BMPs);
< Promote employee ownership of the problems and the solutions; and
< Integrate employee feedback into training and BMP implementation.

APPROACH:

< Integrate training regarding stormwater quality management with existing training programs that may be required for other regulations.
< Employee training is a vital component of many of the individual source control BMPs included in this manual.

PROGRAM ELEMENTS

: New Development
: Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
: Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
9 Regulatory
■ Training
: Staffing
: Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Hazardous Waste Management

HWM

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

APPLICATION:

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

< Paints and solvents; petroleum products such as oils; fuels and greases; herbicides and pesticides; acids for cleaning masonry; and concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with federal, state and local regulations, including:

< Sandblasting grit mixed with lead, cadmium or chromium based paints, asbestos, and PCBs.

INSTALLATION/APPLICATION CRITERIA:

The following steps will help reduce stormwater pollution from hazardous wastes:

< Use all of the product before disposing of the container.

< Do not remove the original product label, it contains important safety and disposal information.

< Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

LIMITATIONS:

Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste collector.

MAINTENANCE:

< Inspect hazardous waste receptacles and areas regularly.

< Arrange for regular hazardous waste collection.

Materials Adopted From Salt Lake County Engineering Division Guidance Document

PROGRAM ELEMENTS

: New Development
: Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
: Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
9 Heavy Metals
■ Toxic Materials
9 Oxygen Demanding Substances
: Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
: O&M Costs
: Regulatory
: Training
: Staffing
: Administrative

■ High : Medium **9** Low

BMP: Housekeeping Practices

HP

DESCRIPTION:

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals.

APPROACH:

< Pattern a new program after the many established programs from municipalities around the country. Integrate this best management practice as much as possible with existing programs at your municipality.
< This BMP has two key audiences: municipal employees and the general public.
< For the general public, municipalities should establish a public education program that provides information on such items as storm water pollution and beneficial effects of proper disposal on water quality; reading product labels; safer alternative products; safe storage, handling, and disposal of hazardous products; list of local agencies; and emergency phone numbers. The programs listed below have provided this information through brochures or booklets that are available at a variety of locations including municipal offices, household hazardous waste collection events or facilities, and public information fairs.

Municipal facilities should develop controls on the application of pesticides, herbicides, and fertilizers in public right-of-ways and at municipal facilities. Controls may include:

< List of approved pesticides and selected uses.
< Product and application information for users.
< Equipment use and maintenance procedures.
< Record keeping and public notice procedures.

LIMITATIONS:

There are no major limitations to this best management practice.

PROGRAM ELEMENTS

9 New Development
: Residential
9 Commercial Activities
9 Industrial Activities
: Municipal Facilities
9 Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
9 Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
: O&M Costs
9 Regulatory
■ Training
: Staffing
9 Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Illegal Dumping Controls

IDC

DESCRIPTION:

Implement measures to detect, correct, and enforce against illegal dumping of pollutants on streets, into the storm drain system, and into creeks. Substances illegally dumped on streets, into the storm drain system, and into creeks includes paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes can cause storm water and receiving water quality problems as well as clog the storm drain system.

APPROACH:

One of the keys to success is increasing the general public's awareness of the problem and to at least identify the incident, if not correct it. There are a number of ways of accomplishing this:

< Train municipal staff from all departments to recognize and report incidents.
< Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act.
< Educate the public.
< Provide the public with a mechanism for reporting such as a hot line.

Establish system for tracking incidents which will identify:

< Illegal dumping "hot spots",
< Types and quantities (in some cases) of wastes,
< Patterns in time of occurrence (time of day/night, month, or year),
< Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accident/spills), and
< Responsible parties.

A tracking system also helps manage the program by indicating trends, and identifying who, what, when, and where efforts should be concentrated.

LIMITATIONS

The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal.

PROGRAM ELEMENTS

9 New Development
9 Residential
9 Commercial Activities
9 Industrial Activities
9 Municipal Facilities
: Illegal Discharges

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

: Sediment
9 Nutrients
: Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

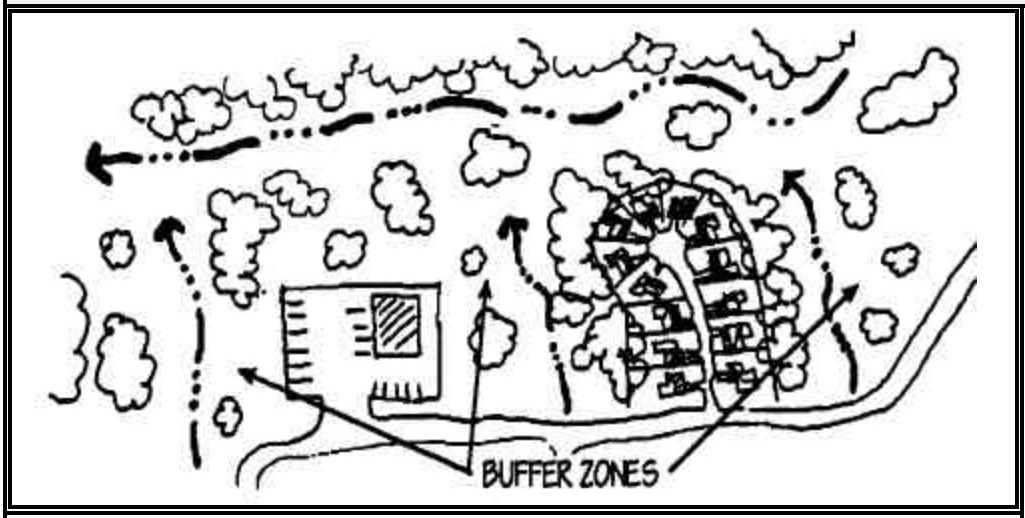
9 Capital Costs
: O&M Costs
9 Regulatory
■ Training
: Staffing
9 Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Land Use Planning/Management

LUPM



DESCRIPTION:

This BMP represents an important opportunity to reduce pollutants in stormwater runoff by using a comprehensive planning process to integrate water quality concerns into the development and redevelopment process. It is applicable to all types of land use and represents one of the most effective pollution prevention practices.

APPROACH:

The land use planning process need not be complex. A basic schematic model involves:

- < Phase I - Goals: Determine clear-cut water quality goals.
- < Phase 2 - Study: Identify planning area, gather pertinent data, and write a description of the planning area and its associated problems.
- < Phase 3 - Analysis and Synthesis: Determine and prioritize the water quality needs as they relate to land use.
- < Phase 4 - Recommendations: Future courses of action are developed to address the identified problems and needs determined previously.
- < Phase 5 - Adoption: The recommendations are presented to a political body for acceptance and implementation.
- < Phase 6 - Implementation: Recommendations adopted by the political body are implemented by the locality.

LIMITATIONS:

- < Land use planning/management frequently addresses sensitive public issues. Restrictions on certain land uses for the purpose of mitigating stormwater pollution may be politically unacceptable.
- < The use of land use controls and planning for water quality improvements may be limited by the lack of staff to enforce various aspects of local zoning and building codes.
- < The planning process addresses many public needs and legal requirements which often are in conflict with one another. It is difficult but extremely important to integrate and balance these sometimes competing programs.

PROGRAM ELEMENTS

: New Development
9 Residential
9 Commercial Activities
9 Industrial Activities
9 Municipal Facilities
9 Illegal Discharges

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ENGINEERING DIVISION
MANAGING THE FUTURE

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9 Low or Unknown Impact

■ Sediment
: Nutrients
■ Heavy Metals
■ Toxic Materials
9 Oxygen Demanding Substances
9 Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

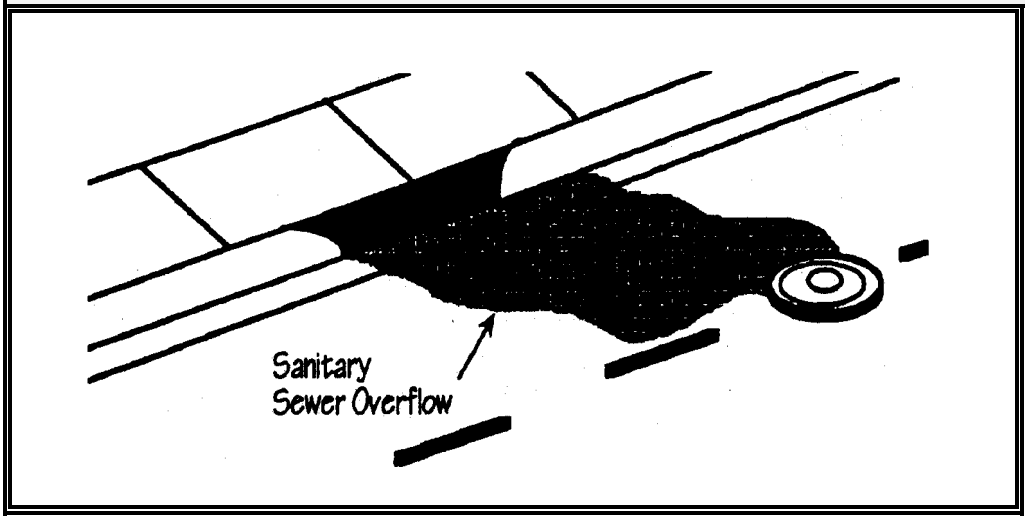
9 Capital Costs
9 O&M Costs
■ Regulatory
9 Training
: Staffing
9 Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Leaking Sanitary Sewer Control

LSSC



DESCRIPTION:

Implement control procedures for identifying, repairing, and remediating sewer blockages, infiltration, inflow, and wet weather overflows from sanitary sewers into the storm drain conveyance system. Procedures include field screening, follow-up testing, and complaint investigation.

APPROACH:

< Identify dry weather infiltration and inflow first. Wet weather overflow connections are very difficult to locate.
< Locate wet weather overflows and leaking sanitary sewers using conventional source identification techniques.
< Coordinate with ongoing infiltration and inflow (I & I) program to locate sources of exfiltration during I & I inspections.
< Design, site, operate, and maintain on-site sewage disposal systems to prevent nutrient/pathogen loadings to surface waters and to reduce loadings to groundwater.

Leaking sanitary sewer detection techniques include:

< Field screening program (including field analytical testing),
< Fluorometric dye testing,
< Zinc chloride smoke testing,
< Television camera inspection,
< Nessler Reagent test kits for ammonia detection,
< Citizens' hotline reporting of wet weather sanitary overflows.

LIMITATIONS:

< Private property access rights needed to perform field screening/testing along storm drain right-of-ways.
< Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

PROGRAM ELEMENTS

9 New Development
: Residential
: Commercial Activities
: Industrial Activities
9 Municipal Facilities
: Illegal Discharges

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9 Toxic Materials
■ Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
■ O&M Costs
9 Regulatory
: Training
■ Staffing
: Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Litter Control

LC

DESCRIPTION:

Litter control involves the removal of litter from streets and other surfaces before runoff or wind moves these materials to surface waters. This practice will prevent litter from becoming pollution as well as improving the aesthetics of the area.

APPROACH:

There are two categories of litter control programs: source reduction and removal programs.

Source reduction:

< Litter containers should be conveniently placed and emptied frequently to prevent overflow.
< Recycling programs should be promoted.
< Public education programs should be developed since litter control programs depend upon public support.

Litter removal programs:

< Litter control program include refuse and leaf collection, street cleaning, and catch basin cleaning.
< Educational programs that explain the environmental benefit of leaf collection to water quality are helpful.
< Municipal leaf collection is usually accomplished with street sweepers (see Street Cleaning BMP) or mechanical lawn sweepers.

LIMITATIONS:

No limitations.

PROGRAM ELEMENTS

: New Development
: Residential
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IMPLEMENTATION REQUIREMENTS

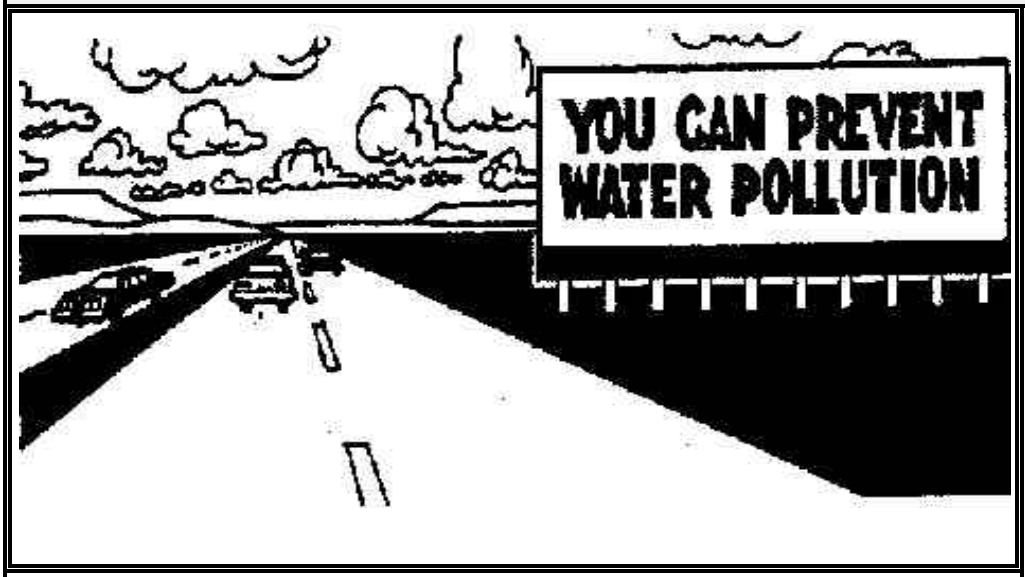
9 Capital Costs
: O&M Costs
9 Regulatory
: Training
: Staffing
: Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Public Education/Participation

PEP



DESCRIPTION:

Public education/participation, like an ordinance or a piece of equipment, is not so much a best management practice as it is a method by which to implement BMPs. This information sheet highlights the importance of integrating elements of public education and participation into a municipality's overall plan for stormwater quality management.

A public education and participation plan provides the municipality with a strategy for educating its employees, the public, and businesses about the importance of protecting stormwater from improperly used, stored, and disposed of pollutants. Municipal employees must be trained, especially those that work in departments not directly related to stormwater but whose actions affect stormwater. Residents must become aware that a variety of hazardous products are used in the home and that their improper use and disposal can pollute stormwater. Increased public awareness also facilitates public scrutiny of industrial and municipal activities and will likely increase public reporting of incidents.

APPROACH:

< Pattern a new program after the many established programs around the country.
< Implement public education/participation as a coordinated campaign in which each message is related to the last.
< Present a clear and consistent message and image to the public regarding how they contribute to stormwater pollution and what they can do to reduce it.
< Utilize multi-media to reach the full range of audiences.
< Translate messages into the foreign languages of the community to reach the full spectrum of your populace and to avoid misinterpretation of messages.
< Create an awareness and identification with the local watershed.
< Use everyday language in all public pieces. Use outside reviewers to highlight and reduce the use of technical terminology, acronyms, and jargon.
< Make sure all statements have a sound, up-to-date technical basis. Do not contribute to the spread of misinformation.
< Break complicated subjects into smaller more simple concepts. Present these concepts to the public in a metered and organized way to avoid "overloading" and confusing the audience.

PROGRAM ELEMENTS

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■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

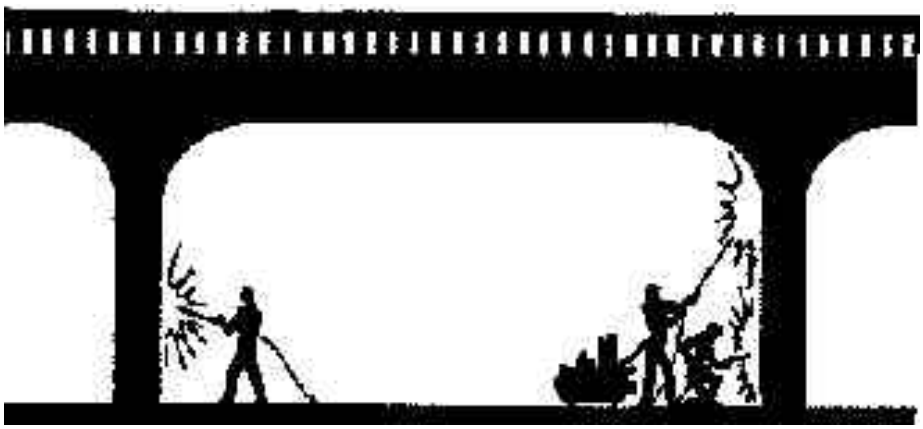
■ Capital Costs
: O&M Costs
9 Regulatory
: Training
: Staffing
: Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Roadway/Bridge Maintenance

RBM



DESCRIPTION:

Address stormwater pollution from roadway and bridge maintenance on a site-specific basis. The deposition and subsequent magnitude of pollutants found in road and bridge runoff is variable and affected by climate, surrounding land use, roadway or bridge design, traffic volume, and frequency and severity of accidental spills.

APPROACH:

Prevent or reduce the discharge of pollutants to stormwater from roadway and bridge maintenance by:

< paving as little as possible,

< designing bridges to collect and convey stormwater,

< using measures to prevent runon and runoff,

PROGRAM ELEMENTS

9 New Development
9 Residential
9 Commercial Activities
9 Industrial Activities
: Municipal Facilities
9 Illegal Discharges

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IMPLEMENTATION REQUIREMENTS

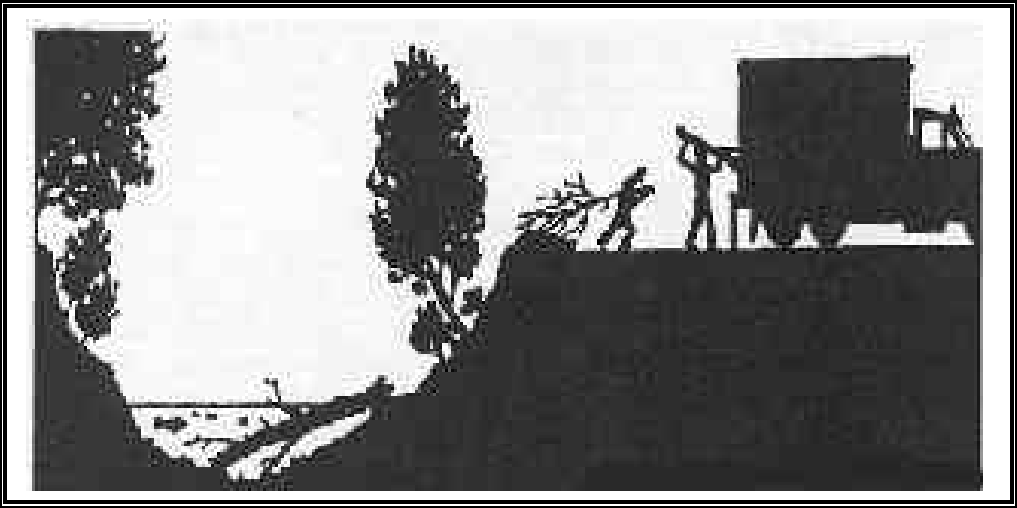
9 Capital Costs
9 O&M Costs
9 Regulatory
: Training
9 Staffing
9 Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Storm Channel/Creek Maintenance

SCCM



DESCRIPTION:

Reduce pollutant levels in stormwater by removing illegally dumped items and material from storm drainage channels and creeks. Modify channel characteristics to enhance pollutant removal and/or hydraulic capacity.

APPROACH:

< Identify illegal dumping hot spots; regular inspection and clean up of hot spots and other storm drainage areas where illegal dumping and disposal occurs.
< Post "No Littering" signs with a phone number for reporting a dumping in-progress.
< Adopt and enforce substantial penalties for illegal dumping and disposal.
< Modify storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetics and habitat value.
< Maintain accurate logs to evaluate materials removed and improvements made.

LIMITATIONS:

< Clean-up activities may create a slight disturbance for local aquatic species.
< Access to items and material on private property may be limited.
< Trade-offs may exist between channel hydraulics and water quality/riparian habitat.
< Worker/public safety may be at risk in crime-ridden areas.
< If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation.

PROGRAM ELEMENTS

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9 Residential
9 Commercial Activities
9 Industrial Activities
: Municipal Facilities
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: Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
: O&M Costs
: Regulatory
: Training
: Staffing
9 Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Storm Drain Flushing

SDF

DESCRIPTION:

A storm drain is "flushed" with water to suspend and remove deposited materials. Flushing is particularly beneficial for storm drain pipes with grades too flat to be self-cleansing. Flushing helps ensure pipes convey design flow and remove pollutants from the storm drain system.

APPROACH:

< Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
< Whenever possible, flushed effluent should be collected, decanted, evaporated, and disposed of in a landfill.

LIMITATIONS:

< Most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity).
< Water source must be available.
< May have difficulty finding downstream area to collect sediments.
< Requires liquid/sediment disposal.

PROGRAM ELEMENTS

9 New Development
9 Residential
9 Commercial Activities
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: Municipal Facilities
9 Illegal Discharges

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■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
■ O&M Costs
9 Regulatory
: Training
■ Staffing
9 Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Storm Drain System Signs

SDSS

DESCRIPTION:

Stenciling of the storm drain system (inlets, catch basins, channels, and creeks) with prohibitive language/graphic icons discourages the illegal dumping of unwanted materials.

APPROACH:

< Create a volunteer work force to stencil storm drain inlets.
< An important aspect of a stenciling program is the distribution of informational flyers that educate the neighborhood (business and residential) about stormwater pollution, the storm drain system, and the watershed. The flyers should also provide information on alternatives such as recycling, household hazardous waste disposal, and safer products.
< Because a stenciling program primarily involves volunteer services, liability release forms and volunteer identification notices should also be administered.
< Readability of stencils is critical to their effectiveness. Wherever possible stencils should be painted on a smooth surface such as cement, as opposed to asphalt.
< Use municipal staff to erect signs near drainage channels and creeks.
< An effectively implemented stenciling program encourages change in personal behavior and helps minimize non-point source pollutants from entering the storm drain system. An additional benefit is that waste and catch basin maintenance is minimized through the reduction of disposed materials into storm drain inlets. Finally a well-implemented stenciling program encourages the use of household hazardous waste collection and used oil recycling programs.

LIMITATIONS:

< Private property access limits stenciling to publicly-owned areas.
< Program is highly dependent on volunteer response.
< Storm drain inlets that are physically blocked will be missed or require follow-up.
< High traffic/commercial/industrial zones are the responsibility of city staff.
< Ongoing maintenance is needed to maintain readable signs.

PROGRAM ELEMENTS

: New Development
: Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
: Illegal Discharges

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IMPLEMENTATION REQUIREMENTS

9 Capital Costs
: O&M Costs
9 Regulatory
: Training
9 Staffing
9 Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Street Cleaning

SC

DESCRIPTION:

Reduce the discharges of pollutants to stormwater from street surfaces by conducting street cleaning on a regular basis.

APPROACH:

< Prioritize cleaning to use the most sophisticated sweepers, at the highest frequency, and in areas with the highest pollutant loading.
< Restrict street parking prior to and during sweeping.
< Increase sweeping frequency just before the rainy season.
< Proper maintenance and operation of sweepers greatly increase their efficiency.
< Keep accurate operation logs to track programs.
< Reduce the number of parked vehicles using regulations.
< Sweepers effective at removing smaller particles (less than 10 microns) may generate dust that would lead to concerns over worker and public safety.
< Equipment selection can be key for this particular BMP. There are two types used, the mechanical broom sweepers (more effective at picking up large debris and cleaning wet streets), and the vacuum sweepers (more effective at removing fine particles and associated heavy metals). Many communities find it useful to have a compliment of both types in their fleet.

LIMITATIONS:

< Conventional sweepers are not able to remove oil and grease.
< Mechanical sweepers are not effective at removing finer sediments.
< Effectiveness may also be limited by street conditions, traffic congestion, presence of construction projects, climatic conditions and condition of curbs.

MAINTENANCE:

< Replace worn parts as necessary.
< Install main and gutter brooms of the appropriate weight.

PROGRAM ELEMENTS

9 New Development
9 Residential
9 Commercial Activities
9 Industrial Activities
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: Illegal Discharges

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IMPLEMENTATION REQUIREMENTS

■ Capital Costs
■ O&M Costs
: Regulatory
: Training
■ Staffing
: Administrative

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Vehicle Use Reduction

VUR

UTA RIDESHARE

533-RIDE

DESCRIPTION:

Reduce the discharge of pollutants to stormwater from vehicle use by highlighting the stormwater impacts, promoting the benefits to stormwater of alternative transportation, and integrating initiatives with existing or emerging regulations and programs.

APPROACH:

< Integrate this best management practice as much as possible with efforts being developed and implemented by government agencies and businesses to reduce vehicle use and improve air quality. Integration will help avoid redundant and/or conflicting programs and be more effective and efficient.

< Establish trip reduction programs at major employers (government, large businesses).

< Reducing vehicle use begins with land use planning. Frequently used public services (post offices, government offices, etc.) and private businesses (banks, restaurants, retail stores, etc.) should be located in "service hubs" near transportation corridors. Multiple, small service hubs should be established as opposed to fewer, large hubs to reduce travel time and thus promote alternative transportation.

< Municipalities and large businesses with significant numbers of employees working in the same location should be encouraged to establish trip reduction programs. These programs encourage alternative transportation such as carpooling, buses, bicycles, walking, etc. through incentives including monetary compensation, increased parking fees, and subsidized public transit passes.

< Public education should highlight the benefits to stormwater in public outreach pieces and campaigns. The benefits to water quality of reduced vehicle usage are second only to the benefits to air quality.

LIMITATIONS:

The use of alternative transportation is highly dependent on its convenience and relative cost.

PROGRAM ELEMENTS

: New Development
: Residential
9 Commercial Activities
9 Industrial Activities
: Municipal Facilities
9 Illegal Discharges

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IMPLEMENTATION REQUIREMENTS

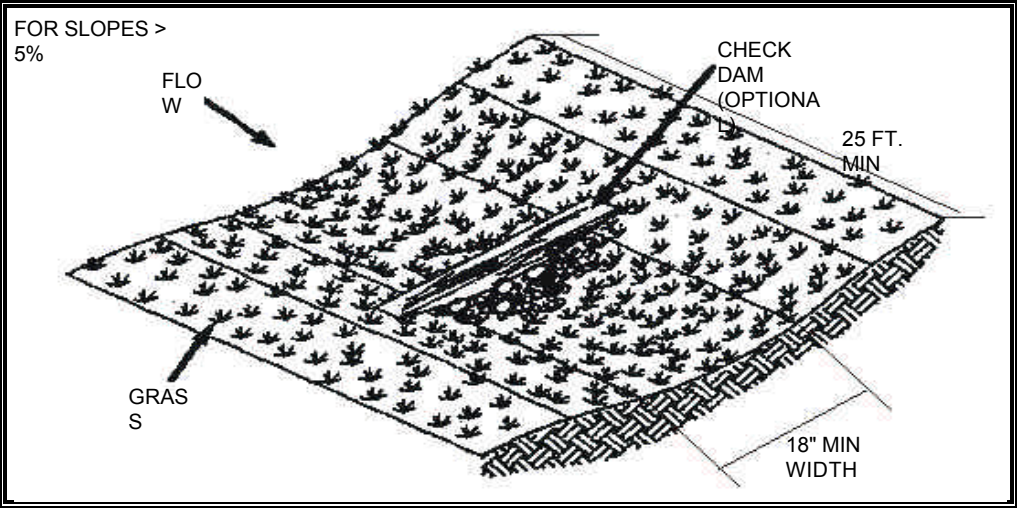
: Capital Costs
9 O&M Costs
: Regulatory
: Training
: Staffing
: Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Biofilters

BF



DESCRIPTION:

Biofilters are of two types: swale and strip. A swale is a vegetated channel that treats concentrated flow. A strip treats sheet flow and is placed parallel to the contributing surface.

APPLICATION:

Suitable for small catchment areas of a few acres.

INSTALLATION/APPLICATION CRITERIA:

< Comparable performance to wet ponds and constructed wetlands.
< Limited to treating a few acres and availability of water during dry season.
< The surface area must be defined.
< The minimum width for a swale is determined by Manning's Equation.
< Minimum length of a strip is 10 feet.
< The longitudinal slope must not exceed 5%.
< Use a flow spreader and energy dissipator at the entrance of a swale.
< Good soils are important to achieve good vegetation cover.

LIMITATIONS:

< Poor performance has occurred but this appears to be due to poor design.
< May be limited to areas where summer irrigation is feasible.
< Can be difficult to maintain sheet flow in strips.
< Can be difficult to avoid channelization in swales.
< Cannot be placed on steep slope.
< Area required may make infeasible on industrial sites.
< Proper maintenance required to maintain health and density of vegetation.

MAINTENANCE:

< Make sure soils are suitable for healthy vegetation.
< Level cross-section and even longitudinal slope for swales.
< Achieve sheet flow with strips.

CONSIDERATIONS

: Soils
: Area Required
: Slope
: Water Availability
: Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

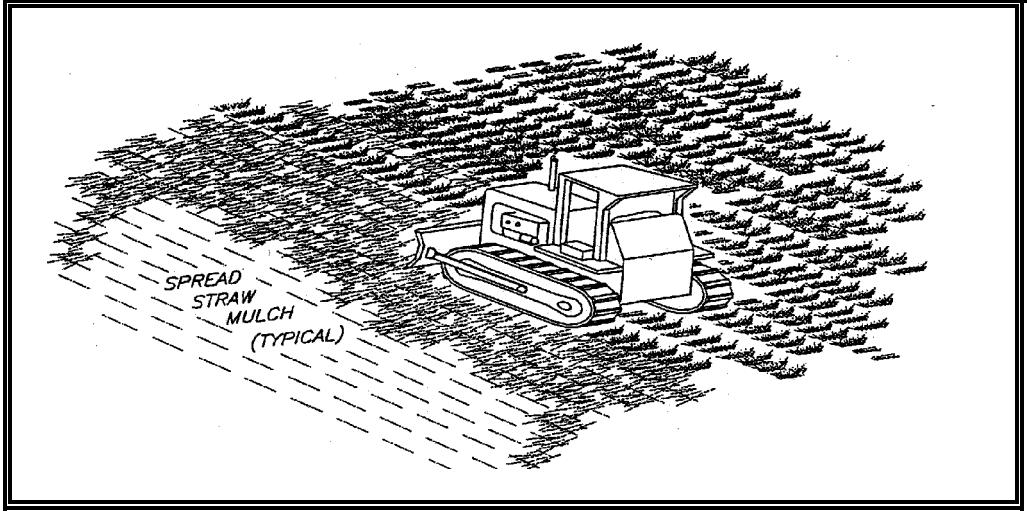
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Chemical Mulch

CM



DESCRIPTION:

Applying materials such as vinyl, asphalt, plastics, or rubber on an unprotected slope to temporarily stabilize the slope.

APPLICATIONS:

- As a tacking agent to aid the stabilization of mulches (where matting is not used).
- As a short-term alternative in areas where temporary seeding practices cannot be used because of seasonal condition or climate.
- On steep and rocky slopes where neither mechanical methods or mulches and protective netting can be effectively applied.

INSTALLATION/APPLICATION CRITERIA:

- The application rates and procedures recommended by the manufacturer of a chemical stabilization product should be followed to prevent the products from forming ponds and from creating large areas where moisture cannot get through.
- For permanent application, chemical mulches (when used with seed and mulch) should be applied over wood fiber or straw mulch.

LIMITATIONS:

- Chemical mulches can create impervious surfaces and impact water quality if not properly applied.
- Some products may not be suitable for use near live streams.

MAINTENANCE:

- Inspect at regular intervals and after each runoff-producing storm event.
- Replace chemical mulch as needed to ensure adequate level of coverage.

OBJECTIVES

9 Housekeeping Practices
9 Contain Waste
9 Minimize Disturbed Areas
: Stabilize Disturbed Areas
: Protect Slopes/Channels
9 Control Site Perimeter
: Control Internal Erosion

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3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
9 Toxic Materials
9 Oil & Grease
9 Floatable Materials
9 Other Waste

IMPLEMENTATION REQUIREMENTS

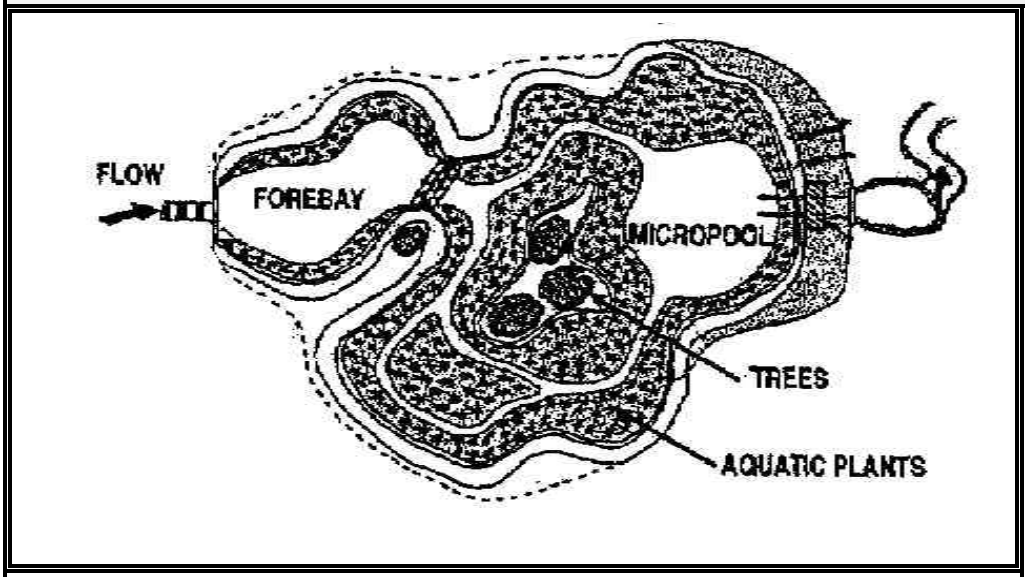
: Capital Costs
9 O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adapted From Salt Lake Country Engineering Division Guidance Document

BMP: Constructed Wetlands

CW



DESCRIPTION:

Constructed wetlands have a significant percentage of the facility covered by wetland vegetation.

APPLICATION:

< Need to achieve high level of particulate and some dissolved contaminant removal.
< Ideal for large, regional tributary areas.
< Multiple benefits of passive recreation and wildlife.

INSTALLATION/APPLICATION CRITERIA:

< Suitable soils for wetland vegetation are required.
< Surface area equal to at least 1% and preferably 2% of the tributary watershed.
< Include a forebay for extra storage and to trap incoming sediment.
< Involve qualified wetland ecologist to design and install wetland vegetation.
< Establishing wetland vegetation may be difficult.

LIMITATIONS:

< Concern for mosquitoes.
< Cannot be placed on steep unstable slopes.
< Need base flow to maintain water level.
< Not feasible in densely developed areas.
< Nutrient release may occur during winter.
< Overgrowth can lead to reduced hydraulic capacity.
< Regulatory agencies may limit water quality to constructed wetlands.

MAINTENANCE:

< Remove foreign debris and sediment build-up.
< Areas of bank erosion should be repaired.
< Remove nuisance species.
< Control mosquitoes.

CONSIDERATIONS

: Soils
: Area Required
: Slope
: Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

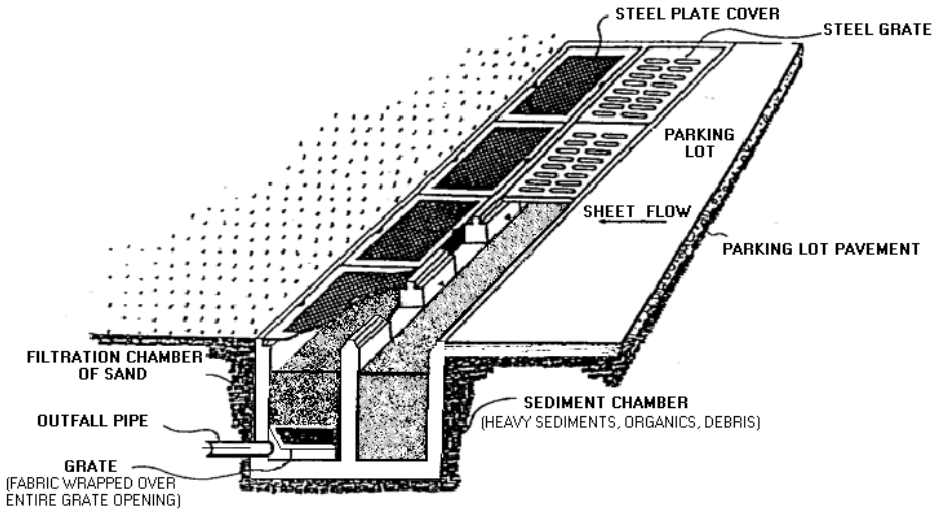
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP: Double Trench Sand Filter

DTSF



DESCRIPTION:

The double trench sand filter (AKA Delaware sand filter) is a BMP consisting of parallel sedimentation and sand filter trenches connected by a series of level weir notches to assure sheet flow onto the filter. Filtered runoff is conveyed to a storm sewer by gravity flow or by pumping.

APPLICATION:

- Commercial and institutional parking lots, small shopping centers, infill developments.
- Smaller redevelopment sites where the use of conventional BMPs is not practical.

INSTALLATION/APPLICATION CRITERIA:

- Requires very little hydraulic head.
- Need to consider structural design with traffic load.

LIMITATIONS:

- Will not prevent small floatable debris from entering through the grate openings.
- Disposing of petroleum-contaminated sand may require expertise in hazardous waste disposal.
- Sand filter may clog sooner than other BMPs requiring more frequent maintenance.

MAINTENANCE:

- System should be inspected yearly and after storm events to assess the filtration capacity of the filter.
- Filter sand should be replaced every few years to maintain pollutant removal efficiency.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

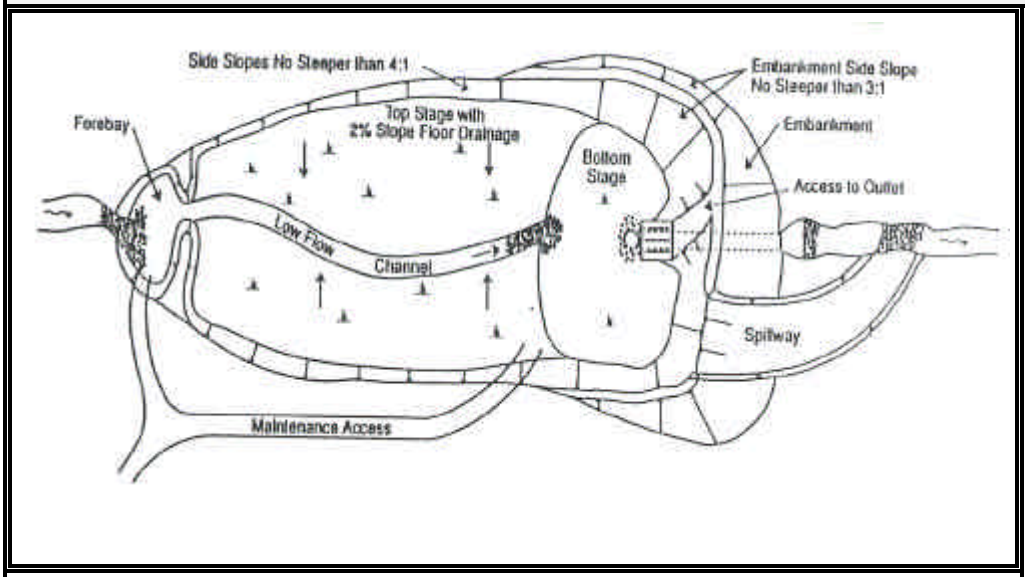
IMPLEMENTATION REQUIREMENTS

■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

BMP: Extended Detention Basins

EDB



DESCRIPTIONS:

Extended detention basins are dry between storms. During a storm the basin fills. A bottom outlet releases the stormwater slowly to provide time for sediments to settle.

APPLICATION:

< Objective is to remove only particulate pollutants.
< Use where lack of water prevents the use of wet ponds, wetlands or biofilters.
< Use where wet ponds or wetlands would cause unacceptable mosquito conditions.

INSTALLATION/APPLICATION CRITERIA:

< Basin volume is sized to capture a particular fraction of the runoff.
< Drawdown time of 24 to 40 hours.
< Shallow basin with large surface area performs better than deep basin with same volume.
< Place energy dissipators at the entrance to minimize bottom erosion and resuspension.
< Vegetate side slopes and bottom to the maximum extent practical.
< If side erosion is particularly severe, consider paving or soil stabilization.
< If floatables are a problem, protect outlet with trash rack or other device.
< Provide bypass or pass through capabilities for 100-year storm.

LIMITATIONS:

< May be less reliable than other treatment control BMPs. Inability to vegetate banks and bottom may result in erosion and resuspension.
< Limitation of the orifice diameter may preclude use in small watersheds.
< Requires differential elevation between inlet and outlet.

MAINTENANCE:

< Check outlet regularly for clogging.
< Check banks and bottom of basin for erosion and correct as necessary.
< Remove sediment when accumulation reaches 6-inches, or if resuspension is observed.

CONSIDERATIONS

9 Soils
: Area Required
9 Slope
9 Water Availability
: Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Floatable Skimmers

FS

DESCRIPTION:

Floatable skimmers are devices used to retain floating debris and oil in detention areas. The floating debris and oil eventually sinks to the bottom of the detention area and becomes part of the sediments or is removed from the surface through regular maintenance.

The effect of floatable skimmers on water quality will depend upon the amount and type of floating material transported by runoff. Typically, a well designed floatable skimmer can trap virtually all floating debris that reaches it. In an area with large amounts of floating leaves, trash or oil, this can provide significant water quality benefits.

APPLICATION:

Applicable in areas where detention basins are used.

INSTALLATION/APPLICATION CRITERIA:

< For structures with a weir outlet, a baffle weir should be used. It should be located far enough upstream of the weir outlet to prevent high velocity flow through it.

< Generally, it is best to keep velocities at the skimmer less than 1 foot per second.

LIMITATIONS:

Tend to clog with debris.

MAINTENANCE:

Maintenance is very important for the proper function of a floatable skimmer. After runoff events that transport large amounts of floating debris and trash, the skimmer can become clogged with a mat of trapped material. This debris must be removed promptly to maintain the capacity of the structure for future storms.

CONSIDERATIONS

9 Soils
9 Area Required
9 Slope
: Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
: Nutrients
9 Heavy Metals
9 Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

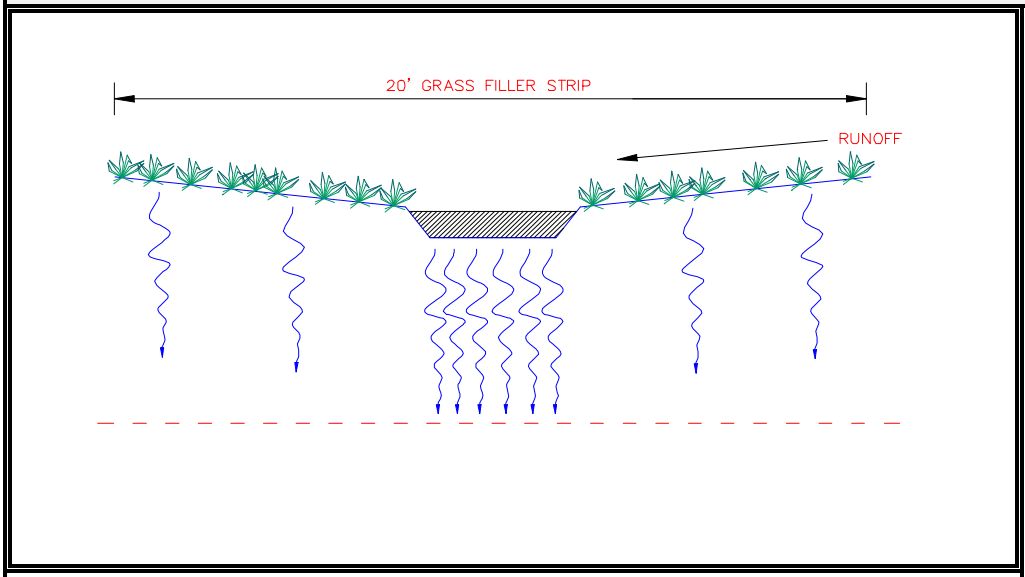
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP: Infiltration

IN



DESCRIPTION:

A family of systems in which the majority of the runoff from small storms is infiltrated into the ground rather than discharged to a surface water body. Infiltration systems include: ponds, vaults, trenches, dry wells, porous pavement, and concrete grids.

APPLICATION:

< Need to achieve high level of particulate and dissolved pollutant removal.
< Suitable site soils and geologic conditions; low potential for long-term erosion in the watershed.
< Multiple management objectives (e.g., ground water recharge or runoff volume control).

INSTALLATION/APPLICATION CRITERIA:

< Volume sized to capture a particular fraction of annual runoff.
< Pretreatment in fine soils.
< Emergency overflow or bypass for larger storms.
< Observation well in trenches.

LIMITATIONS:

< Loss of infiltrative capacity and high maintenance cost in fine soils.
< Low removal of dissolved pollutants in very coarse soils.
< Not suitable on fill sites or steep slopes.
< Risk of ground water contamination in very coarse soils, may require ground water monitoring.
< Should not use until upstream drainage area is stabilized.
< Infiltration facilities could fall under regulations regarding waste disposal to land.

MAINTENANCE:

< Remove sediment at frequency appropriate to avoid excessive concentrations of pollutants and loss of infiltrative capacity.
< Frequent cleaning of porous pavements.
< Maintenance is difficult and costly for underground trenches.

CONSIDERATIONS

: Soils
: Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

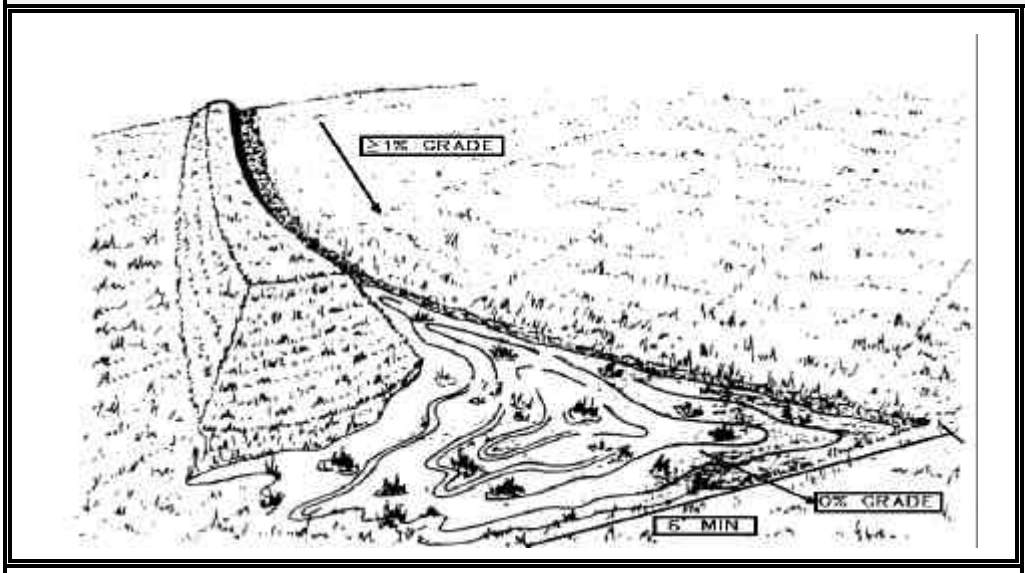
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Level Spreaders

LS



DESCRIPTION:

Level spreaders are devices used at stormwater outlets to spread out collected stormwater flows into sheetflow (runoff that flows over ground surface in a thin, even layer). Typically, a level spreader consists of a depression in the soil surface that spreads the flow onto a flat area across a gentle slope. Level spreaders then release the stormwater flow onto level areas stabilized by vegetation to reduce speed and increase infiltration.

APPLICATION:

Level spreaders are most often used as an outlet for temporary or permanent stormwater conveyances or dikes. Runoff that contains high sediment loads should be treated in a sediment trapping device prior to release into a level spreader.

INSTALLATION/APPLICATION CRITERIA:

< The length of the spreader depends upon the amount of water that flows through the conveyance.
< Larger volumes of water need more space to even out.
< Level spreaders are generally used with filter strips (see Filter Strips BMP).
< The depressions are seeded with vegetation (see Permanent & Temporary Seeding BMP).
< Level spreaders should be constructed on natural soils and not on fill material.
< The entrance to the spreader should be level so that the flow can spread out evenly.
< Level Spreader should have a grade of 0%; minimum width should be 6' and minimum depth should be 6" minimum.

LIMITATIONS:

< Can easily develop "short circuiting" (concentration of flows into small streams instead of sheetflow over the spreader) because of erosion or other disturbance.
< Cannot handle large quantities of sediment-laden stormwater.

MAINTENANCE:

< The spreader should be inspected after every storm event to check for damage.
< If ponding or erosion channels develop, the spreader should be regraded.
< Dense vegetation should be maintained and damaged areas reseeded as needed.

CONSIDERATIONS

: Soils
: Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
9 Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

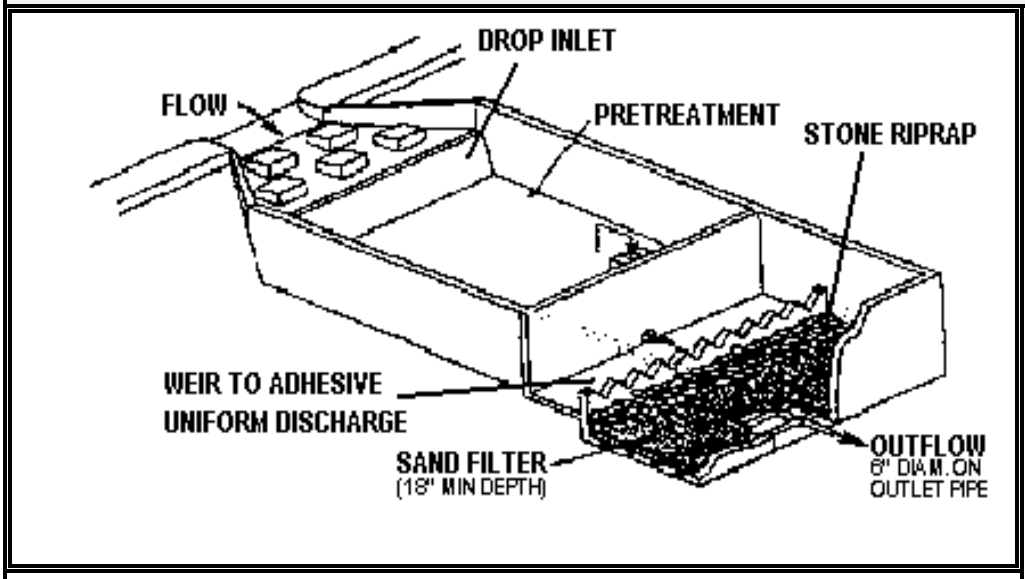
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP: Media Filtration

MF



DESCRIPTION:

Consists of a settling basin followed by a filter. The most common filter media is sand; some use peat/sand mixture.

APPLICATION:

< Objective is to remove only sediment (particulate pollutants).
< Use where unavailability of water prevents the use of wet ponds, wetlands, or biofilters.
< Can be placed underground.
< Suitable for individual developments and small tributary areas up to about 100 acres.
< May require less space than other treatment control BMPs.

INSTALLATION/APPLICATION CRITERIA:

< Settling basin smaller than wet or extended detention basin.
< Spread flow across filter.
< Place filter offline to protect from extreme events.
< Minimize erosion in settling basin.

LIMITATIONS:

< Filter may require more frequent maintenance than most of the other BMPs.
< Head loss.
< Dissolved pollutants are not captured by sand.
< Severe clogging potential if exposed soil surfaces exist upstream.

MAINTENANCE:

Clean filter surface about twice annually; or more often if watershed is excessively erosive.

CONSIDERATIONS

9 Soils
9 Area Required
9 Slope
9 Water Availability
9 Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

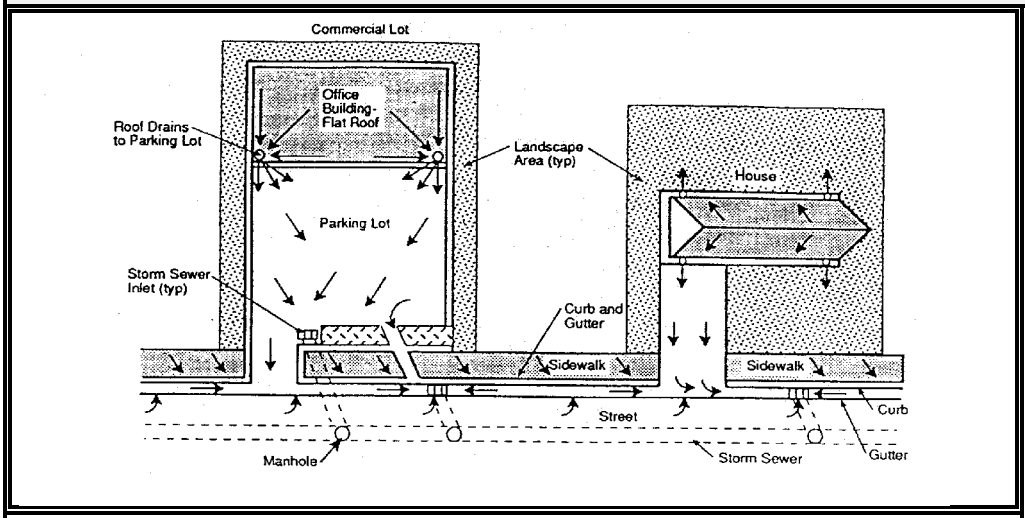
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP: Minimizing DCIAs

DCIA



DESCRIPTION:

Minimizing directly connected impervious areas (DCIAs) is a structural BMP strategy that requires a basic change in drainage design philosophy. The basic principle is to direct stormwater runoff to landscaped areas, grass buffer strips, and vegetated swales to slow down the rate of runoff, reduce runoff volumes, attenuate peak flows, and encourage filtering and infiltration of stormwater.

APPLICATION:

It can be made an integral part of drainage planning for any development.

INSTALLATION/APPLICATION CRITERIA:

< Use on sites with general terrain slopes flatter than 3-4%.
< Design the site drainage flowpath to maximize flow over vegetated areas before leaving a site.
< Minimize ground slopes to limit erosion and slow down water flow.
< Select vegetation that will not only survive, but also enhance water quality.

LIMITATIONS:

< Potential increase in site open space requirements over the traditional development systems.
< Introduction of a nonconventional development design strategy.
< Infiltration of water near building foundations and parking lots is a concern.
< Will likely result in increased maintenance along the swales.

MAINTENANCE:

< Maintain grass and other vegetation.
< Pick up debris.
< Conduct ongoing inspections for potential erosion problems and changes in drainage patterns.
< Remove sediment buildup and replace damaged grass cover.

CONSIDERATIONS

9 Soils
9 Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
: Heavy Metals
9 Toxic Materials
9 Oxygen Demanding Substances
9 Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

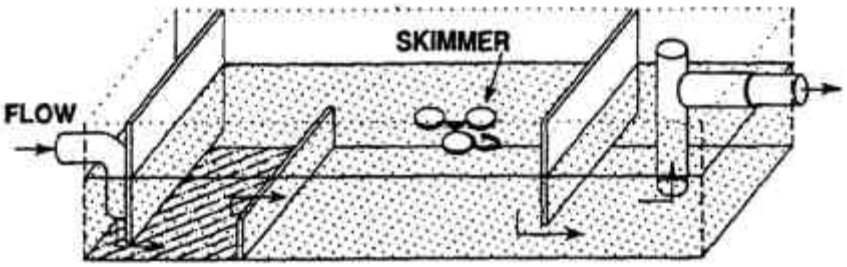
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Oil/Water Separators And Water Quality Inlets

OWS



DESCRIPTION:

Oil/Water separators are designed to remove specific contaminants: petroleum compounds and grease. However, separators will also remove floatable debris and settleable solids. Two general types of oil/water separators are used: conventional gravity separator and the coalescing plate interceptor (CPI).

APPLICATION:

- Applicable to situations where the concentration of oil and grease related compounds will be abnormally high and source control cannot provide effective control. The general types of businesses where this situation is likely are truck, car and equipment maintenance and washing businesses, as well as businesses that perform maintenance on their own equipment and vehicles.
- Public facilities where separators may be required include marine ports, airfields, fleet vehicle maintenance and washing facilities, and mass transit park-and-ride lots.
- Conventional separators are capable of removing oil droplets with diameters equal to greater than 150 microns.
- CPI separators should be used if smaller droplets must be removed.

INSTALLATION/APPLICATION CRITERIA:

- Sizing related to anticipated influent oil concentration, water temperature and velocity, and the effluent goal.
- To maintain reasonable separator size, it should be designed to bypass flows in excess of first flush.

LIMITATIONS:

- Little data on oil characteristics in stormwater leads to considerable uncertainty about performance.
- Air quality permit may be required.

MAINTENANCE:

Clean frequently of accumulated oil, grease, and floating debris.

CONSIDERATIONS

9 Soils
: Area Required
9 Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

: Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

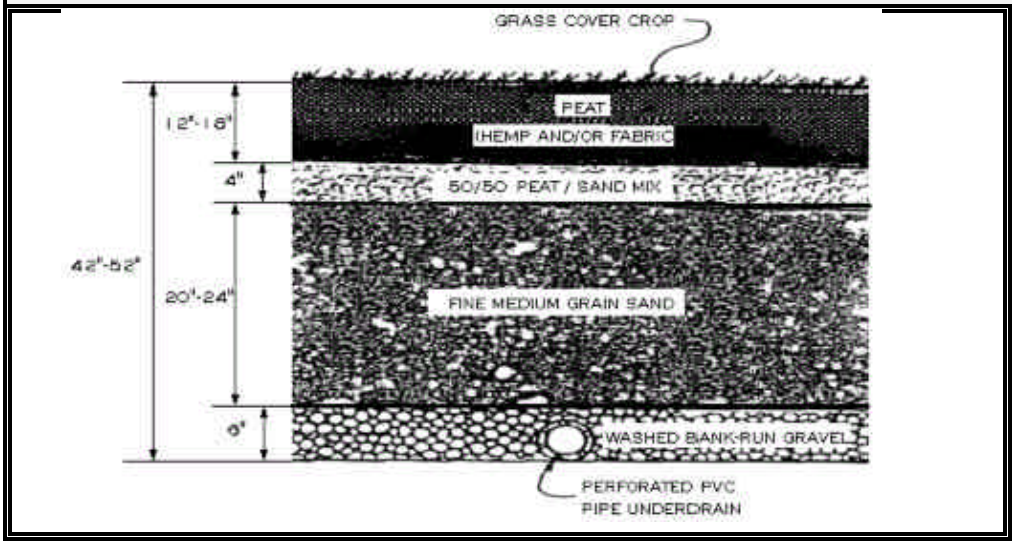
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Peat-Sand Filter System

PSFS



DESCRIPTION:

A filter system containing fibric or hemic peat and consisting of a sedimentation chamber or pond, a surface vertical filter system, a grass cover crop, and alternating layers of peat and sand all underlain by collector pipes in a gravel bed.

APPLICATION:

< Development where insufficient space exists for a wet pond.
< Development where higher rates of pollutant removal are preferred.

INSTALLATION/APPLICATION CRITERIA:

< Use only fibric or hemic peat. Sapric peat will result in system failure.
< Can be used in high water table areas.
< Peat will not remove pollutants if it becomes oxygen depleted.

LIMITATIONS:

< Suitable peat material may not always be available.
< System must be shut down during the winter months.
< Sites with little or no gradient may prevent sufficient gravity flow through the system.
<

MAINTENANCE:

During dry seasons or periods of drought the cover crop may require irrigation.

< Remove silt when accumulation exceeds 6" (15.2 cm).
< Remove accumulated trash and debris every 6 months or as necessary.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
■ Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

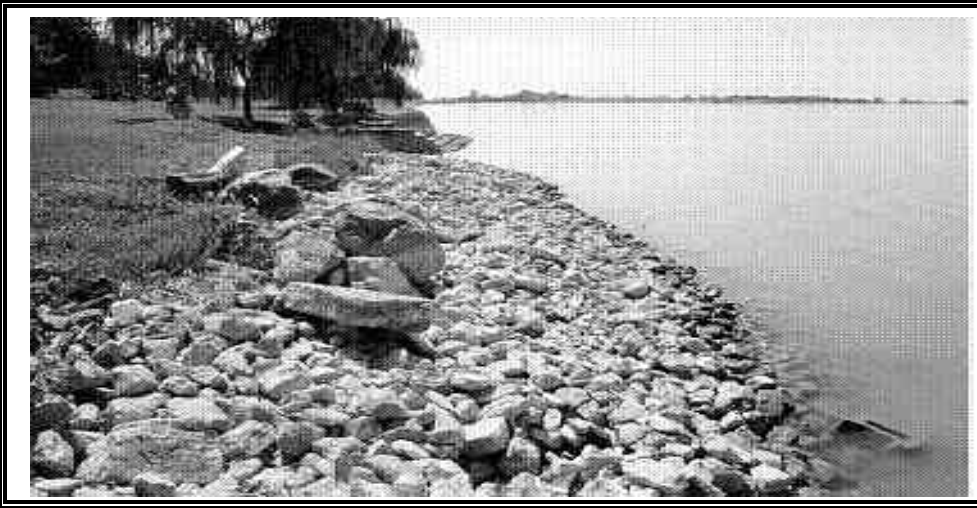
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Riprap

RR



DESCRIPTION:

Riprap is a permanent, erosion-resistant protective layer made of loose stones. It is intended to protect soil from erosion in areas of concentrated runoff. Riprap may also be used to stabilize slopes that are unstable because of seepage problems.

APPLICATION:

< Riprap is normally used at locations where erosive forces from water flow exceed the ability of the soil or vegetative cover to resist those forces.
< Riprap can be used for pipe outlet protection, channel lining, scour protection, etc.
< Riprap is commonly used for wave protection on lakes.

INSTALLATION/APPLICATION CRITERIA:

< For slopes steeper than 2:1, consider using materials other than riprap for erosion protection.
< If riprap is being planned for the bottom of a permanently flowing channel, the bottom can be modified to enhance fish habitat. This can be done by constructing riffles and pools which simulate natural conditions.
< When working within flowing streams, measures should be taken to prevent excessive turbidity and erosion during construction. Bypassing base flows or temporarily blocking base flows are two possible methods. Work should be done during a period of low flow.

In designing riprap consider the following:

< Use durable rock, such as granite, and a variety of rock sizes.
< The thickness of riprap layers should be at least 1.25 times the max. stone diameter.
< Filter material is usually required between riprap and the underlying soil surface.

LIMITATIONS:

< Riprap may be unstable on very steep slopes.
< The placement of a riprap in streams requires a state stream alteration permit.

MAINTENANCE:

< Riprap should be inspected annually and after major storms.
< If riprap has been damaged, repairs should be made promptly to prevent a progressive failure.
< If repairs are needed repeatedly at one location, the site should be evaluated to see if original design conditions have changed.

CONSIDERATIONS

: Soils
: Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

West Valley City Stormwater Utility
West Valley City Engineering Division
3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

Stormwater Utility Credit Information: 801-963-3406
Stormwater Hotline: 801-963-3334
Stormwater Management Plan Review: 801-963-3318
Stormwater Permit: 801-963-3318

TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

: Sediment
9 Nutrients
9 Heavy Metals
9 Toxic Materials
9 Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

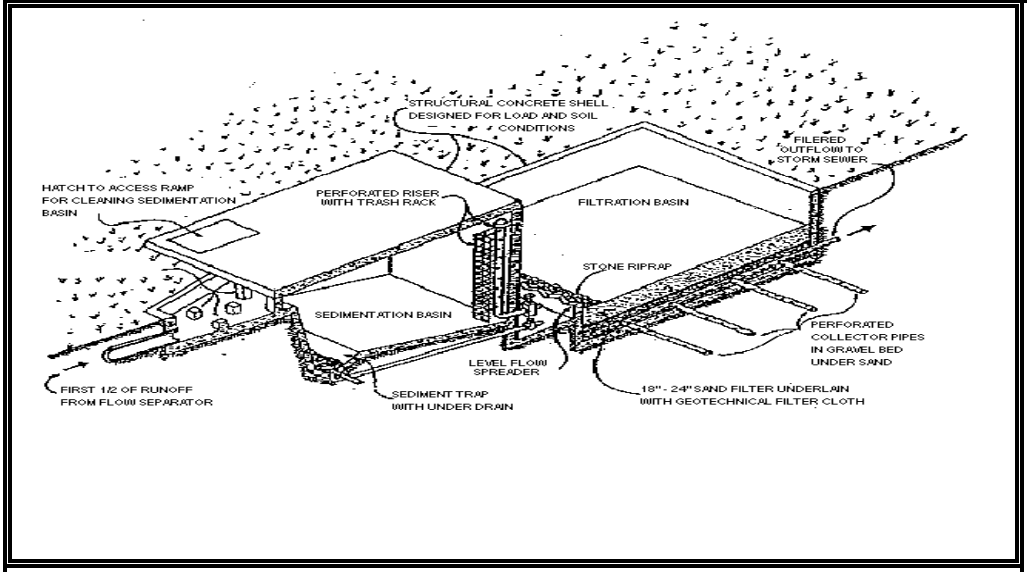
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP: Surface Sand Filter System

SSFS



DESCRIPTION:

The surface sand filter system (aka Austin sand filter) consists of a sedimentation chamber or pond followed by a surface sand filter with collector under drains in a gravel bed. Filtered runoff is conveyed to a storm sewer or channel by gravity flow or by pumping.

APPLICATIONS:

< Commercial and institutional parking lots, small shopping centers, and infill development.
< Smaller redevelopment sites where the use of conventional BMPs is not practical.

INSTALLATION/APPLICATION CRITERIA:

< Filter bed chambers that are too shallow could freeze, causing the filter to become ineffective.
< Pretreatment may be necessary to protect the filter media from excessive sediment loading.
< System should be designed for easy maintenance.

LIMITATIONS:

< Sites with little to no gradient may prevent sufficient gravity flow through the system.
< Extended periods of cold weather could affect pollutant removal efficiency.

MAINTENANCE:

< System should be inspected yearly and after storm events to assess the filtration capacity of the filter.
< Filter sand should be replaced every few years to maintain pollutant removal efficiency.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

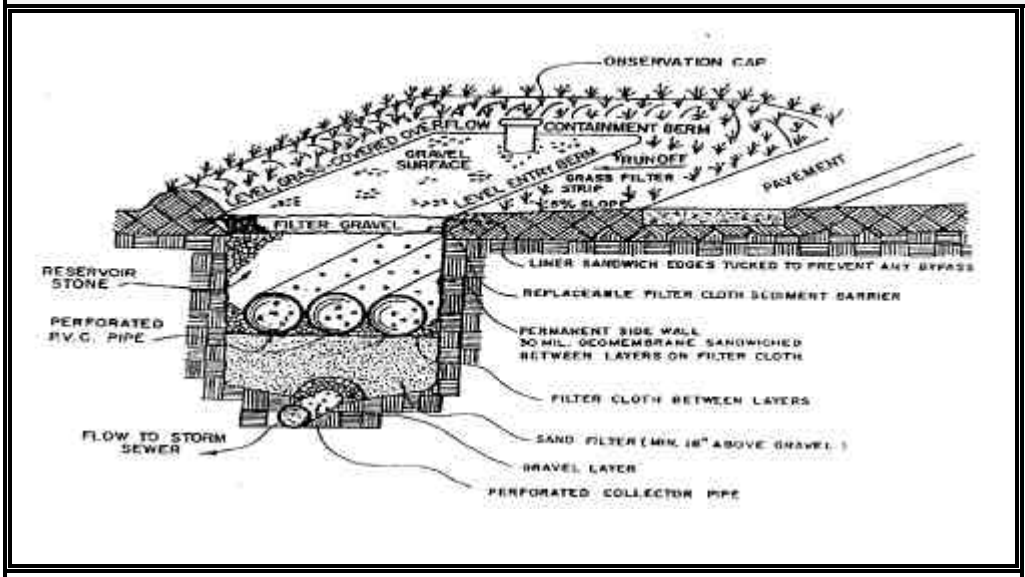
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP:Trench Sand Filter System

TSFS



DESCRIPTION:

An adaptation of the surface sand filter system. The trench sand filter system has two variations. One variation consists of a trench sand filter system with a stone reservoir. The other variation consists of a trench sand filter system with a small sedimentation pond.

APPLICATION:

< Townhouse developments or small commercial redevelopments

INSTALLATION/APPLICATION CRITERIA:

< Topography should offer sufficient relief to allow the system to function by gravity flow.
< Design for easy maintenance accessibility.
< Design for safety barriers which prevent children from entering the sedimentation pond.

LIMITATIONS:

< Sites with little or no gradient may prevent sufficient gravity flow through the systems.
< Not recommended for parking lots.

MAINTENANCE:

< Stone reservoirs will require periodic replacement of the upper filter cloth and gravel layer.
< Sedimentation ponds will require periodic removal of accumulated sediment.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

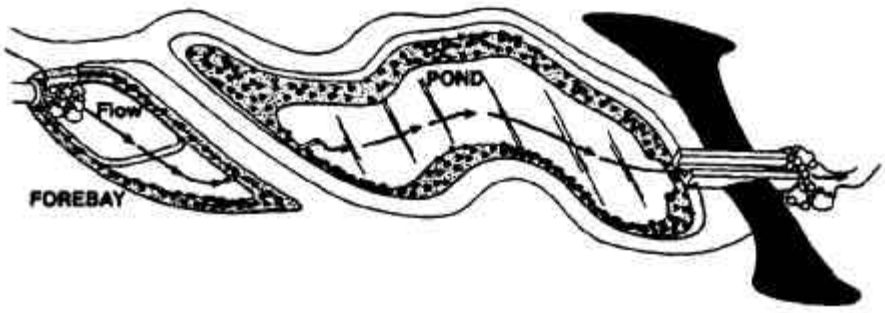
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

BMP: Wet Ponds

WP



DESCRIPTION:

A wet pond has a permanent water pool to treat incoming stormwater. An enhanced wet pond includes a pretreatment sediment forebay.

APPLICATION:

< Need to achieve high level of particulate and some dissolved contaminant removal.
< Ideal for large, regional tributary areas.
< Multiple benefits of passive recreation (e.g. bird watching, wildlife habitat).

INSTALLATION/APPLICATION CRITERIA:

< Water depth of 3 to 9 feet.
< Wetland vegetation, occupying 25-50% of water surface area.
< Design to minimize short-circuiting.
< Bypass storms greater than two year storm.
< Establishing wetland vegetation may be difficult.

LIMITATIONS:

< Concern for mosquitoes and maintaining oxygen in ponds.
< Cannot be placed on steep unstable slopes.
< Need base flow or supplemental water if water level is to be maintained.
< Infeasible in very dense urban areas.
< May require permits from various regulatory agencies, e.g.,Corps of Engineers.

MAINTENANCE:

< Remove floatables and sediment build-up.
< Correct erosion spots in banks.
< Control mosquitoes.

CONSIDERATIONS

: Soils
: Area Required
: Slope
: Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted from Salt Lake County Engineering Division Guidance Document

CHAPTER 5

STORMWATER DISCHARGE MANAGEMENT FROM COMMERCIAL AND INDUSTRIAL ACTIVITIES

Pollutants of Concern
Selection of Best Management Practices
References
BMP Information Sheets

CHAPTER 5 - Stormwater Discharge Management from Industrial Activities

On November 16, 1990, the EPA issued a final rule for NPDES permit applications. The rule requires facilities with "stormwater discharge associated with industrial activity" to apply for a stormwater discharge permit. The State of Utah has primacy over the National Pollution Discharge Elimination System (NPDES) program and has adopted the federal regulations to issue Utah Pollution Discharge Elimination System (UPDES) permits. "Stormwater discharge associated with industrial activities" is defined as the discharge from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant.

The regulations have broadly defined eleven categories of industrial activity in which a facility must be engaged to be subject to the stormwater regulations. The eleven industrial categories are summarized below:

1. Heavy manufacturing facilities;
2. Medium manufacturing facilities;
3. Mines (active or inactive) and oil and gas facilities;
4. Hazardous waste treatment storage and disposal facilities;
5. Landfills, disposal facilities;
6. Recycling facilities (scrap/salvage yards);
7. Steam electric generating facilities;
8. Selected transportation facilities;
9. Domestic sewage treatment works;
10. Construction activities disturbing five or more acres of land; and
11. Other industrial facilities exposed to stormwater.

The first ten categories, generally referred to as "heavy" industry, must obtain a State of Utah stormwater permit for stormwater discharges associated with industrial activity. The very large eleventh category, often called "light" industry, need to apply for a stormwater permit only if stormwater physically contacts products, materials, materials handling equipment or activities, or other industrial activity equipment or sites.

The purpose of this chapter is to assist the owners/operators of these regulated industries in developing and implementing practices for stormwater quality management. In addition, owner/operators of other industries, not identified in the regulations, will find this guidance document useful in selecting best management practices for their facilities.

This chapter is organized into two sections. The first section lists some of the pollutants of concern relating to industrial activities and explains their potential impacts on water quality. The second section provides guidance in developing and implementing best management practices (BMPs) for pollutant control. One requirement of the industrial permit is to develop and implement a stormwater pollution prevention plan. Refer to Chapter 6 for guidelines for the preparation of a stormwater pollution prevention plan.

POLLUTANTS OF CONCERN

Because of the many different types of industries, there can be a wide variety of pollutants that make it into stormwater runoff. Industrial operations are known sources of heavy metals, oily wastes and other pollutants. Industrial plants can have very different stormwater quantities, flow patterns and potential pollutants. Even different facilities of the same industry may need different approaches to reducing pollutant discharges to stormwater. Therefore, it is imperative that the owner/operator of each facility understand the potential pollutants

and impacts from their individual processes. This chapter will only discuss the most typical pollutants found in industrial stormwater runoff.

Solids, nutrients, metals, oxygen demanding substances, bacteria and viruses, and oil and grease are the pollutants most frequently associated with stormwater runoff at industrial sites These pollutants are discussed in the following subsection and also summarized in Table 5-1.

Solids

Solids (often referred to as total or suspended solids) can cause many receiving water problems. First, it can cause direct toxicity to aquatic organisms, through such mechanisms as fouling of gills, suffocation, etc. Second, high solids concentrations can reduce water clarity. Third, solids act as a vehicle to transport other pollutants. Excessive solids are often the result of poor construction practices at the industrial site.

Nutrients

Excessive nutrients such as nitrogen and phosphorus in the receiving water can cause problems by stimulating the growth of algae or rooted aquatic plants. Excessive plant growth can cause dissolved oxygen problems, reduce biologic diversity, worsen aesthetics, or impair use for water supply. Some industrial activities typically associated with nutrients include fertilizer/pesticide manufacturing and distribution, waste treatment, and food processing.

Metals

Metals, especially "heavy" metals can be toxic at very low concentrations. Metals can also bio-accumulate in fish and other species and be passed on to higher levels of the food chain, including humans. Certain metals including cadmium, copper, lead, silver, and zinc are the most common metals which contaminate waterways. Industrial activities which commonly deal with metals include mining, electroplating, cement, battery production, and metal recycling.

Oxygen-Demanding Substances

Oxygen-demanding substances tend to deplete the dissolved oxygen levels in streams and lakes. The depleted oxygen supply can result in loss of aquatic life. Oxygen demanding substances are commonly found in food processing industries and chemical manufacturing plants.

Bacteria and Viruses

Bacteria and viruses are the most common microorganisms found in surface water runoff. Bacteria and viruses often carry diseases which can be transferred to animal life and to humans. Food processing and medical wastes are often associated with microbiological contamination.

Oil and grease

Oil and grease contain a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. Industrial sources of oil and grease are generally associated with automobile related industries such as: repair shops, body and paint shops, retail distribution, and dismantlers/recyclers.

Floatables

Trash and litter from industrial sites may contain amounts of pollutants which will effect stormwater quality. Floatables in waterways and drainage systems pose both aesthetic and maintenance problems.

Other Toxic Materials (Priority Pollutants)

Facilities may contribute other toxic materials to storm water in low concentrations. Pesticides, phenols and polynuclear or polycyclic aromatic hydrocarbons (PAHs) are most frequently found in stormwater discharges associated with industrial operations.

Table 5-1. Potential pollutants associated with industrial activities

Pollutant	Potential Source
Solids	Poor erosion control on construction sites, unpaved parking lots, material storage, equipment cleaning
Nutrients	Waste treatment, building materials, fertilizers, illegal and illicit sanitary connections
Cadmium	Electroplaters, batteries, pigments for paint, smelting and refining of ores, solder, scrap metal recyclers, plastic stabilizers and alloys, incinerators, photography, enamels, manufacture of fungicides
Copper	Electrical products, industry machinery, electroplating, corrosion inhibitors, pigments in paint, incineration, wood preservatives, pesticide, fungicide, and herbicide manufacturing and distribution
Lead	Mining, waste from smelting operations, metal and pipe fabricators, welding, manufacture of storage batteries and television tubes, pigments in paint, fuels, photographic materials, ammunition and explosives
Silver	Electro-plating, photographic processing/supplies, electronics manufacturing, cement manufacture, medical and dental supplies, bearing linings in aircraft engines, emissions from smelting operations and incinerators
Zinc	Galvanizing agent, preparation of alloys for die casting, brass and bronze alloys, slush castings, electroplating, photoengraving and printing, steam cleaners, wood pulp, paint pigments, and batteries
Oxygen Demanding Substances	Food processing, organic chemical use
Bacteria and Viruses	Food processing, medical waste
Oil, Grease, and Hydrocarbons	Auto-related industries, repair shops, body and paint shops, retail distribution, material and equipment storage, equipment cleaning operations Businesses, cleaners, solvents, fast foods, grease, litter, etc.

BEST MANAGEMENT PRACTICES

For many facilities, stormwater pollution can be prevented with common-sense precautions and modest changes in routine operations or maintenance practices. Below is a general process to select applicable best management practices (BMPs).

GENERAL FACILITY MANAGEMENT PRACTICES

The following best management practices are general in nature and can be implemented at all types of industrial facilities. These practices can be deemed pollution prevention measures, in that they are aimed at reducing or containing pollutants at the source, preventing their release to stormwater.

Because stormwater pollution control practices take a number of forms and includes a wide array of practices, specific changes or adaptations to your facility may be required. However, stormwater pollution control may be summarized by the following three principals:

- Prevent water from contacting work or storage areas;
- Keep pollutants off surfaces that come into contact with stormwater; and
- Training.

These practices will be described in more detail below.

Prevent water from contacting work or storage areas

Small spills can have cumulative effects that add up to a significant source of potential pollutants in your stormwater discharge. The best approach by far is to prevent spills and leaks, maintain a regular inspection and repair schedule, and correct potential spill situations before a spill can occur.

When a spill does occur, quick and effective response is the best way to prevent pollutants from reaching stormwater. Prepare a set of well-defined procedures for responding to a spill of any liquids in an area that might be exposed to stormwater. The procedures can be specific for your facility, and should consider all circumstances from small, minor releases that can be easily handled to a large emergency spill—including who to call to respond to the situation before it gets out of hand.

Keep general shop trash in a dumpster with the lid closed. Put the dumpster in a paved area, not on unpaved soil or your lawn. Keep the area clean by picking up dropped trash and sweeping the area regularly (perhaps once a week), but don't use a hose to clean up — keep water off the area. Nearly all dumpsters and trash compactors leak; keep liquid wastes out of them, and keep them closed to keep stormwater out.

Keep pollutants off surfaces that come into contact with stormwater

When handling bulk solid materials outdoors, keep them covered, in appropriate containments, and protected from stormwater. Apply this policy for raw materials, products, by-products, and construction materials or supplies. Materials of concern include gravel, sand, lumber, topsoil, compost, concrete, packing materials, metal products, and others.

Parking lots or other surfaces near bulk materials storage facilities should be swept periodically to remove fines that may wash out of the materials, which will otherwise wash away with stormwater. Larger bulk material storage facilities will need more extensive structural controls designed for the specific facility and material.

Training

Training employees in these BMPs is beneficial because a single employee's mistake or mis-understanding at the wrong time, in the wrong

place, can lead to a costly pollution incident. After selecting the BMPs that apply to your facility, add training in the BMPs to the regular employee training procedures.

Provide general information as well, because employees often respond best if they understand why they are being asked to conduct a new procedure. Employees' suggestions in return can help identify cost-effective stormwater controls for your facility. Provide positive feedback so employees understand the difference they each make in protecting the waterways.

BMP SELECTION

Best management practices for industrial activities can be separated into two broad categories: source control and treatment control. Source control are practices designed to prevent pollution by reducing potential pollutants at the source. Treatment controls are methods of treatment to remove pollutants from stormwater. Source control BMPs are preferred because they are nearly 100% effective if correctly implemented and are often less expensive than treatment controls. A five-step process for the selection of BMPs is identified below.

Step 1: Identify and Evaluate BMPs In-Place
It is likely that many BMPs have already been put into place out of a desire for good housekeeping or financial savings. Examples are berming, covered material storage, and designated wash areas. These already implemented BMPs may need to be "tightened up" to meet SWPPP objectives.

Step 2: Consider low or moderate cost source controls
As state previously, source controls are nearly 100% effective if properly implemented and maintained. Many source controls such as pollution prevention training of employees or regular facility maintenance will meet regulation requirements and are relatively easy and inexpensive to implement.

Step 3: Consider Other Source Controls For activities in which it is clear that the BMPs selected in step 2 will not be adequate, consider more extensive source controls. This could include covering the activity of concern. Even if installing a cover or canopy is more expensive than other source controls, it has the advantage of not only being 100% effective, but in some industries it may avoid the need for a general permit.

Step 4: Choose Applicable Treatment Controls
Treatment control BMPs may need to be implemented if:

- Extensive source control BMPs are needed and a treatment control BMP is more cost-effective;
- You are required to meet a numeric effluent limit that cannot be met with source control BMPs; or,
- There is a pollutant of particular concern that can only be controlled with a treatment control BMP.

Step 5. Prepare BMP List and Prioritize
At this point, a list of all BMPs and their locations at the site can be made. Before implementation of these BMPs, review these considerations:

1. Have the identified BMPs that fulfill the minimum obligations defined in the general permit?
2. Have the identified possible low and nominal-cost BMPs.
3. Have the developed strategy to deal with those activities that will still be significant sources of pollution for which more expensive BMPs are needed?

4. Is there a requirement to comply with numeric effluent limits, and if so, have you identified the specific BMPs to fulfill this obligation?
5. Have the prepared training program to provide the proper background to the employees who will implement the BMPs?
6. Is there a commitment and schedule for implementation of BMPs, maintenance, inspection, and ongoing evaluation (More information concerning BMP maintenance and monitoring is contained in Chapter 6 - "How to Prepare a SWPPP").

REFERENCES

State of California. March 1993. “California Storm Water Best Management Practice Handbooks.”

USE OF SOURCE CONTROL BMP INFORMATION SHEETS

Attached are specific source control Best Management Practices (BMPs) for common industrial activities. The list is not exhaustive and variations are acceptable provided implemented controls meet regulatory requirements.

Each information sheet is organized into three main sections:

- Heading
- Main Body
- Side Bar

HEADING

In addition to the title of the BMP, a 2 to 4 letter abbreviation of the BMP is provided in the upper right-hand corner. The abbreviation may be used for identifying the selected BMP on the Storm Water Pollution Prevention Plan (SWPPP) Site Map. The information sheet for the selected BMP can then be attached to the SWPPP to provide details regarding purpose, installation, and maintenance.

MAIN BODY

The main body in each BMP sheet contains the following information:

- Example illustration of the BMP;
- description of the BMP;
- approach;
- limitation; and
- maintenance (where necessary).

SIDE BAR

The side bar presents information on where the BMP applies, targeted constituents, and an indication of the level of effort and cost to implement.

Applications:
Manufacturing
Material Handling
Vehicle Maintenance
Construction
Commercial Activities
Roadways
Waste Containment
Housekeeping Practices

Targeted Pollutants:
Sediment
Nutrients
Heavy Metals
Toxic Materials
Floatable Materials
Oxygen Demanding Substances
Oil & Grease
Bacteria & Viruses

Each information sheet provides an indication of whether the BMP will have a high, medium, or low/unknown impact on removing these constituents.

Implementation Requirements:
Costs:
- Capital Costs
- O&M Costs

Level of effort associated with:
- Maintenance
- Training

Each information sheet indicates the relative cost or level of effort (high, medium, low) to implement the BMP.

DECISION MATRIX

The source control BMPs for industrial activities are listed in the decision matrix on the following pages. The matrix is provided to give the user a relatively easy way to identify applicable BMPs. The user should understand that the matrix is only a guide and should not be used in place of sound engineering judgement.

To use the matrix, identify the type(s) of industrial activity which apply (going horizontally across the top of the sheet). Once identified, select the BMPs (running vertically along the left side of the sheet) which can be used with the particular activity.

USE OF TREATMENT CONTROL BMP INFORMATION SHEETS

Attached are specific treatment control Best Management Practices (BMPs) for common commercial and industrial activities that may pollute stormwater. The list is not exhaustive and variations are acceptable provided implemented controls meet regulatory requirements. Each information sheet is organized into three main sections:

< Heading
< Main Body
< Side Bar

HEADING

In addition to the title of the BMP, a 2 to 4 letter abbreviation of the BMP is provided in the upper right-hand corner. The abbreviation may be used for identifying the selected BMP on the Storm Water Pollution Prevention Plan (SWPPP) Site Map. The information sheet for the selected BMP can then be attached to the SWPPP to provide details regarding purpose, installation, and maintenance.

MAIN BODY

The main body in each BMP sheet contains the following information:

< Example illustration of the BMP;
< description of the BMP;
< application;
< installation/application criteria;
< maintenance; and
< limitations.

SIDE BAR

The side bar presents information on where the BMP applies, targeted constituents, and an indication of the level of effort and cost to implement.

Considerations:

Soils - Is the BMP dependent on soil type and condition?

Area Required - Does BMP require considerable space?

Slope - Can the BMP be placed on or near steep slopes?

Water Availability - Does the BMP require water during dry seasons?

Aesthetics - Will the BMP be visible to the public so that it must be aesthetically pleasing?

Hydraulic Head - Does the BMP require a drop in water elevation to work properly?

Environmental Side Effects - Does the BMP have negative effects (e.g. undesirable insects) or positive effects (e.g. wildlife habitat, recreation)?

Targeted Pollutants:
Sediment
Nutrients
Heavy Metals
Toxic Materials
Floatable Materials
Oxygen Demanding Substances
Oil & Grease
Bacteria & Viruses

Each information sheet provides an indication of whether the BMP will have a high, medium, or low/unknown impact on removing these constituents.

Implementation Requirements:
Costs:
    Capital Costs
    O&M Costs
Level of effort associated with:
    Maintenance
    Training
Each information sheet indicates the relative cost or level of effort (high, medium, low) to implement the BMP.

DECISION MATRIX

The treatment control BMPs for commercial and industrial activities are listed in the decision matrix at the beginning of the BMP section. The matrix is provided to give the user a relatively easy way to identify applicable BMPs. The user should understand that the matrix is only a guide and should not be used in place of sound engineering judgement.

Commercial and Industrial BMPs

		BMP Criteria							
Source Control BMPs to Consider		Manufacturing	Material Handling	Vehicle Maintenance	Construction	Commercial Activities	Roadways	Waste Containment	Housekeeping Practices
ACP	Area Control Procedures	X				X			X
ATL	Aboveground Tank Leak and Spill Control	X	X			X	X	X	
BGM	Buildings and Grounds Maintenance					X	X		X
BRRC	Building Repair, Remodeling and Construction				X	X			X
CD	Containment Dikes	X						X	
CESA	Contaminated or Erodible Surface Areas				X		X		
CO	Covering	X	X	X	X	X		X	X
CU	Curbing	X	X		X	X		X	X
DCUS	De-Icing Chemical Use and Storage		X				X	X	X
DP	Drip Pans	X						X	
ET	Employee Training	X	X	X	X	X	X	X	X
HWM	Hazardous Waste Management	X	X	X	X			X	X
NSWD	Non-Storm Water Discharges to Drains	X		X		X		X	X
OCSL	Outdoor Container Storage of Liquids		X		X	X		X	X
OLUM	Outdoor Loading/Unloading of Materials		X		X	X			X
OPE	Outdoor Process Equipment Operations	X		X	X	X			X
OSRM	Outdoor Storage of Raw Materials	X	X		X	X			X
SL	Signs and Labels	X				X			X
VEC	Vehicle and Equipment Cleaning			X	X	X			X
VEF	Vehicle and Equipment Fueling		X	X	X	X			X
VEMR	Vehicle and Equipment Maintenance & Repair		X	X	X	X			X
WHD	Waste Handling and Disposal		X		X	X		X	X

		BMP Criteria						
Treatment Control BMPs to Consider		Soils	Area Required	Slope	Water Availability	Aesthetics	Hydraulic Head	Environmental Side Effects
BF	Biofilters	X	X	X	X			
CW	Constructed Wetlands	X	X	X	X	X		X
DCIA	Minimizing DCIAs			X		X		
DTSF	Double Trench Sand Filter	X		X				
EDB	Extended Detention Basins		X			X	X	
GA	Gelling Agents							X
IN	Infiltration	X	X	X		X		X
LS	Level Spreaders	X	X	X		X		X
MF	Media Filtration						X	
OWS	Oil/Water Separators and Water Quality		X					
PSF	Peat-Sand Filter System	X		X				
SO	Sorbents							X
SSFS	Surface Sand Filter System	X		X			X	
SU	Sumps						X	
TSF	Trench Sand Filter System	X		X				
WP	Wet Ponds		X	X	X	X		X

BMP: Area Control Procedures

ACP

DESCRIPTION:

Area control procedures involve practicing good housekeeping measures such as maintaining indoor or covered material storage and industrial processing areas. If the area is kept clean, the risk of accumulating materials on footwear and clothing is reduced. In turn, the chance of left over pollutants making contact with stormwater polluting surface water is minimized.

APPROACH:

Area control procedures can be used at any facility where materials may be tracked into areas where they can come in contact with stormwater runoff. Areas can include material handling areas, storage areas, or process areas.

Effective practices include the following:

< Cover garments, foot mats, and other devices used to collect residual material near the area should be cleaned regularly.
< Brush off clothing before leaving the area.
< Stomp feet to remove material before leaving the area.
< Use floor mats at area exits.
< Use coveralls, smocks, and other overgarments in areas where exposure to material is of greatest concern (employees should remove the overgarments before leaving the area).
< Post signs to remind employees about these practices.

LIMITATIONS:

May be seen as tedious by employees and therefore may not be followed.

MAINTENANCE:

Materials storage areas and industrial processing areas should be checked regularly to ensure that good housekeeping measures are implemented.

APPLICATIONS

: Manufacturing
9 Material Handling
9 Vehicle Maintenance
9 Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Heavy Metals
9 Toxic Materials
9 Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

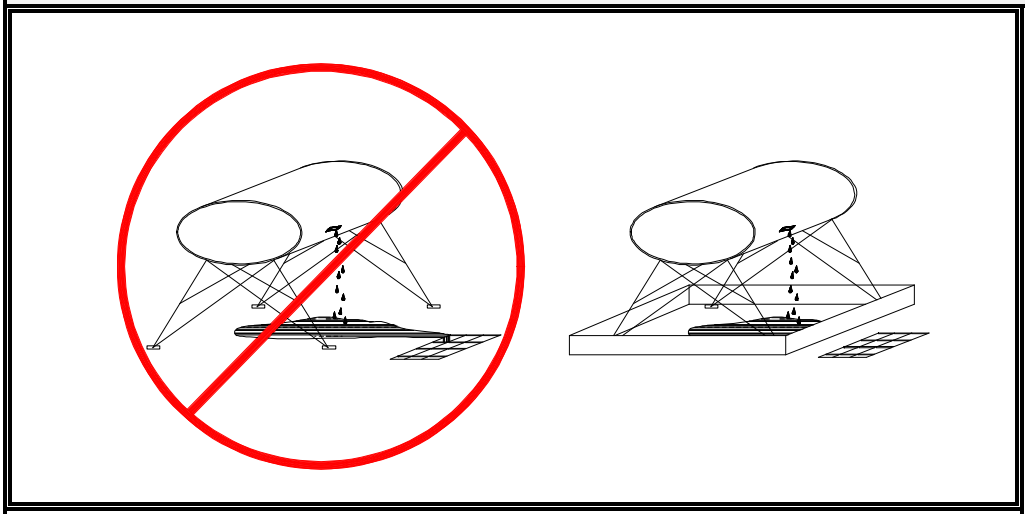
9 Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Aboveground Tank Leak And Spill Control

ATL



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from aboveground storage tanks by installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

The most common causes of unintentional releases are:

< Installation problems,
< Failure of piping systems (pipes, pumps, couplings, hoses, and valves),
< External corrosion and structural failure,
< Spills and overfills due to operator error, and
< Leaks during pumping of liquids or gases from truck to a storage tank or vice versa.

APPROACH:

< Integrate efforts with existing aboveground petroleum storage tank programs through the local Fire Department and Health Department, and area and business emergency response plans through the City, County, or Fire District.
< Use engineering safeguards to reduce the chance for spills.
< Perform regular maintenance.

LIMITATIONS:

For larger spills, a private spill clean-up company or Hazmat team may be necessary.

MAINTENANCE:

Maintenance is critical to preventing leaks and spills. Conduct routine weekly inspections and:

< Check for external corrosion and structural failure,
< Check for spills and overfills due to operator error,
< Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves),
< Check for leaks or spills during pumping of liquids or gases from truck to storage facility or vice versa.
< Periodically, integrity testing should be conducted by a qualified professional.

APPLICATIONS

: Manufacturing
: Material Handling
9 Vehicle Maintenance
9 Construction
: Commercial Activities
: Roadways
: Waste Containment
9 Housekeeping Practices

West Valley City Stormwater Utility
West Valley City Engineering Division
3600 Constitution Blvd. Room 280
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Stormwater Utility Credit Information: 801-963-3406
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Stormwater Permit: 801-963-3318

TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
: Nutrients
: Heavy Metals
■ Toxic Materials
: Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
9 Maintenance
■ Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Building And Grounds Maintenance

BGM

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from buildings and grounds maintenance by washing and cleaning up with as little water as possible, preventing and maintaining the stormwater collection system.

Buildings and grounds maintenance includes taking care of landscaped areas around the facility, cleaning of parking lots and pavement other than in the area of industrial activity, and the cleaning of the storm drainage system.

APPROACH:

< Preserve existing native vegetation to reduce water, fertilizer, and pesticide needs.
< Carefully use pesticides and fertilizers in landscaping.
< Integrate pest management where appropriate.
< Sweep paved surfaces.
< Clean the storm drainage system at appropriated intervals.
< Properly dispose of wash water, sweepings, and sediments.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable or effective in every case.

MAINTENANCE:

The BMPs themselves relate to maintenance and do not require maintenance as they do not involve structures.

APPLICATIONS

9 Manufacturing
9 Material Handling
9 Vehicle Maintenance
9 Construction
: Commercial Activities
: Roadways
9 Waste Containment
: Housekeeping Practices

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■ High Impact
9 Low or Unknown Impact
: Medium Impact

■ Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

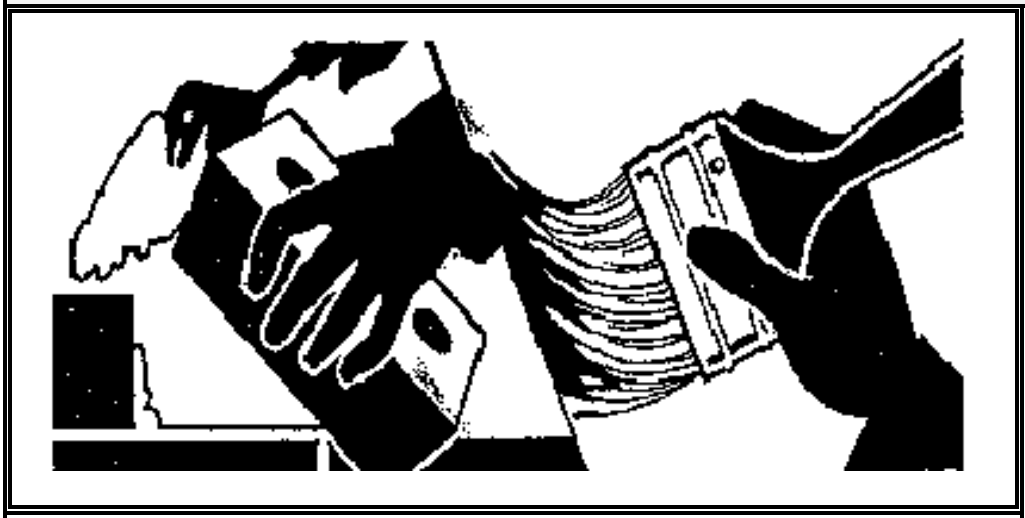
9 Capital Costs
: O&M Costs
: Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Building Repair, Remodeling and Construction

BRRC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

APPROACH:

< Use soil erosion control techniques if bare ground is temporarily exposed.
< Use permanent soil erosion control techniques if the remodeling clears buildings from an area that are not to be replaced.
< Enclose painting operations consistent with local air quality regulations and OSHA.
< Properly store materials that are normally used in repair and remodeling such as paints and solvents.
< Properly store and dispose waste materials generated from the activity.
< Maintain good housekeeping practices while work is underway.

LIMITATIONS:

< This BMP is for minor construction only.
< Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.
< Safer alternative products may not be available, suitable, or effective in every case.
< Be certain that actions to help stormwater quality are consistent with OSHA and air quality regulations.

APPLICATIONS

9 Manufacturing
9 Material Handling
9 Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

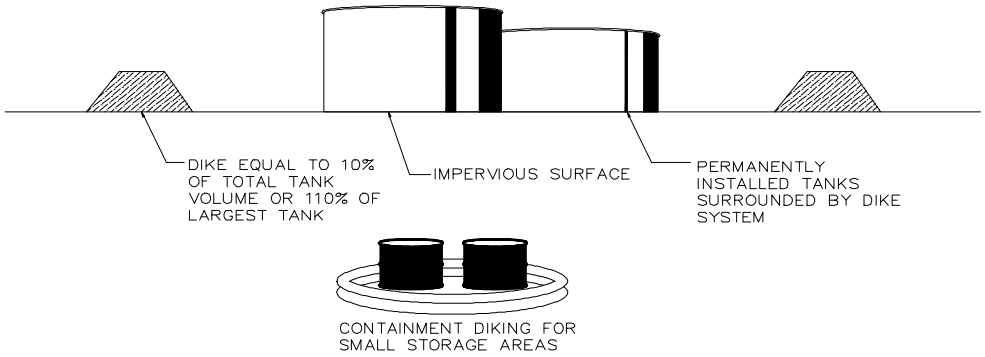
: Capital Costs
: O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Containment Dikes

CD



DESCRIPTION:

Containment dikes are temporary or permanent earth or concrete berms or retaining walls that are designed to hold spills. Diking, one of the most common types of containment, is an effective method of pollution prevention for above-ground liquid storage tanks and rail car or tank truck loading and unloading areas. Diking can provide one of the best protective measures against the contamination of stormwater because it surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater outside of the diked area.

APPROACH:

< Containment dikes should be large enough to hold an amount equal to the largest single storage tank at the particular facility plus the volume of rainfall or 10% of total tank volume.

< Materials used to construct the dike should be strong enough to safely hold spilled materials. Materials used usually depend on what is available onsite and the substance to be contained. The material may consist of earth (i.e., soil or clay), concrete, synthetic materials (liners), metal, or other impervious materials.

< Containment dikes may need to be designed with impervious materials to prevent leaking or contamination of stormwater, surface, and ground water supplies.

< Uncontrolled overflows from diked areas containing spilled materials or contaminated stormwater should be prevented to protect nearby surface and ground waters. Therefore, dikes should have either pumping systems or vacuum trucks available to remove the spilled materials.

LIMITATIONS:

< May be too expensive for small facilities.

< Could collect contaminated stormwater, possibly resulting in infiltration of stormwater to ground water.

MAINTENANCE:

Inspections should be conducted during or after significant storms or spills to check for washouts or overflows. In addition, regular checks of containment dikes (i.e., testing to ensure that dikes are capable of holding spills) is recommended.

APPLICATIONS

: Manufacturing
9 Material Handling
9 Vehicle Maintenance
9 Construction
9 Commercial Activities
9 Roadways
: Waste Containment
9 Housekeeping Practices

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■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

■ Capital Costs
: O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Contaminated or Erodible Surface Areas

CESA

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from contaminated or erodible surface areas by leaving as much vegetation on-site as possible, minimizing soil exposure time, stabilizing exposed soils, and preventing stormwater runon and runoff.

APPROACH:

This BMP addresses soils which are not so contaminated as to exceed criteria but the soil is eroding and carrying pollutants off in the stormwater.

Contaminated or erodible surface areas can be controlled by:

< Preservation of natural vegetation,
< Re-vegetation,
< Chemical stabilization,
< Removal of contaminated soils, or
< Geosynthetics.

LIMITATIONS:

Disadvantages of preserving natural vegetation or re-vegetating include:

< Requires substantial planning to preserve and maintain the existing vegetation.
< May not be cost-effective with high land costs.
< Lack of rainfall and/or poor soils may limit the success of re-vegetated areas.

Disadvantages of chemical stabilization include:

< Creation of impervious surfaces.
< May cause harmful effects on water quality.
< Is usually more expensive than vegetative cover.

MAINTENANCE:

Maintenance should be minimal, except if irrigation of vegetation is necessary.

APPLICATIONS

9 Manufacturing
9 Material Handling
9 Vehicle Maintenance
: Construction
9 Commercial Activities
: Roadways
9 Waste Containment
9 Housekeeping Practices

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■ Sediment
■ Nutrients
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■ Toxic Materials
■ Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

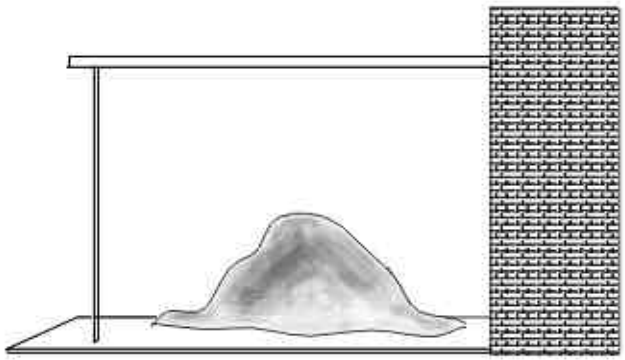
■ Capital Costs
: O&M Costs
9 Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Covering

CO



DESCRIPTION:

Covering is the partial or total physical enclosure of materials, equipment, process operations, or activities. Covering certain areas or activities prevents stormwater from coming into contact with potential pollutants and reduces material loss from wind blowing. Tarpaulins, plastic sheeting, roofs, buildings, and other enclosures are examples of covering that are effective in preventing stormwater contamination. Covering can be temporary or permanent.

APPROACH:

< Covering is appropriate for outdoor material storage piles (e.g., stockpiles of dry materials, gravel, sand, compost, sawdust, wood chips, and de-icing salt) as well as areas where liquids and solids in containers are stored or transferred.
< While it may be too expensive to cover all industrial activities, cover all high-risk areas first (e.g., chemical preparation areas, vehicle maintenance areas, and areas where salts are stored), then according to budget cover the rest of the materials.
< Evaluate the strength and longevity of the covering, as well as its compatibility with the material or activity being enclosed.
< When designing an enclosure, consider access to materials, their handling, and transfer.
< Materials that pose environmental and safety dangers require special ventilation and temperature considerations.
< Covering alone may not protect the materials. When designing, consider placing materials on an elevated, impermeable surface or build curbing around the outside of the materials to prevent problems from runon of uncontaminated stormwater from adjacent areas.
< Anchor all coverings with stakes, tie-down ropes, large rocks, tires or other easily available heavy objects.

LIMITATIONS:

< Requires frequent inspection.
< May pose health or safety problems if enclosure is built over certain activities.

MAINTENANCE:

< Frequently inspect coverings for rips, holes and general wear.

APPLICATIONS

: Manufacturing
: Material Handling
: Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
: Waste Containment
: Housekeeping Practices

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9 Low or Unknown Impact

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: Nutrients
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: Oxygen Demanding Substances
: Oil & Grease
: Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

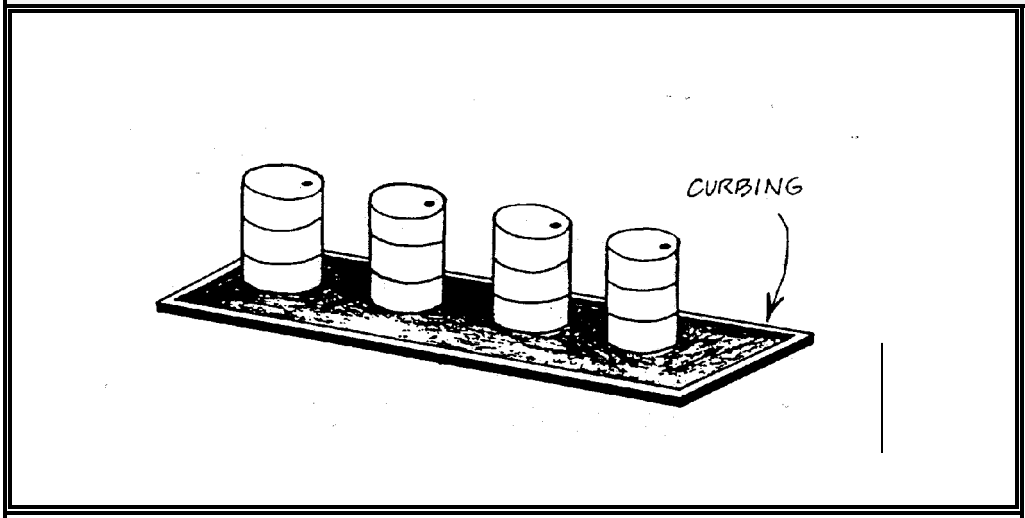
■ Capital Costs
9 O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Curbing

CU



DESCRIPTION:

Curbing is a barrier that surrounds an area of concern, much like containment diking (See Containment Diking BMP). Curbing prevents spills, leaks, etc. from being released to the environment by routing runoff to treatment or control areas. The terms curbing and diking are sometimes used interchangeably.

APPROACH:

< Curbing can be used at all industrial facilities. It is particularly useful in areas where liquid materials are transferred and as a stormwater runoff control.
< As with diking, common materials for curbing include earth, concrete, synthetic materials, metal, or other impenetrable materials. Asphalt is also a common material used in curbing.
< For maximum efficiency, spilled materials should be removed immediately, to allow space for future spills.
< Curbs should have pumping systems, instead of drainage systems, for collecting spilled materials.
< Curb systems should be maintained through curb repair (patching and replacement).
< To minimize the amount of spilled material tracked outside of the area by personnel, grade within the curbing to direct the spilled materials to a down-slope side of the curbing, thus keeping the spilled materials away from personnel and equipment. Grading will also facilitate clean-up.

LIMITATIONS:

< Curbing is not effective for holding large spills.
< May require more maintenance than diking.

MAINTENANCE:

< Inspection should be conducted before and after storm events.
< When certain spills occur, cleanup should start immediately, thus preventing overflows and contamination of stormwater runoff.
< Inspection should also be made to clear clogging debris, prevent dilution by rainwater, and to again prevent overflow of any materials.

APPLICATIONS

: Manufacturing
: Material Handling
9 Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
: Waste Containment
: Housekeeping Practices

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: Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: De-Icing Chemical Use and Storage

DCUS

DESCRIPTION:

A sizeable amount of de-icing chemicals are used each winter on roads, parking lots, and sidewalks in Utah. Sodium chloride (salt) is the main chemical used. Proper use and storage of salt will reduce the chance of high chloride concentration in runoff that may damage the environment.

APPROACH:

< Proper storage practices can control sodium chloride pollution in runoff from stockpiles.
< For de-icing use, preventing over-application of salt will reduce quantities of chloride reaching surface or ground water.
< All salt piles should be covered with polyethylene if not stored in a shed. All sand/salt piles should be moved too empty salt sheds or covered during the spring and summer.
< Any runoff from stockpiles should be contained.
< To prevent over-application of salt one must properly calibrate the equipment and monitor the need for de-icing material.
< Another method to prevent the over-application of salt is to limit salt application on low traffic areas and straight level areas, critical areas will, however, need higher levels of service.

LIMITATIONS:

< All deicers hold the potential for damaging grass and plant biota should their concentration within the soil becomes unusually high. In amounts recommended for sidewalk and driveway deicing, there is minimal chance of damage to trees, grass, and shrubs. This is especially true if the chemical is used sparingly -- only to undercut snow and ice -- and the slush is not plowed or shoveled into grassy or planted areas.
< Another concern of many businesses and homeowners is the visible deicer residue that may be tracked into a building. This residue occurs because these deicers are solids in their natural state. However, since the residue is water soluble, it cleans up readily using plain water or ordinary household cleaner.
< Salt should not be used to melt every bit of snow and ice. Use only enough to break the ice/pavement bond, then remove the remaining slush by plowing or shoveling.

APPLICATIONS

9 Manufacturing
: Material Handling
9 Vehicle Maintenance
9 Construction
9 Commercial Activities
: Roadways
: Waste Containment
: Housekeeping Practices

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9 Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

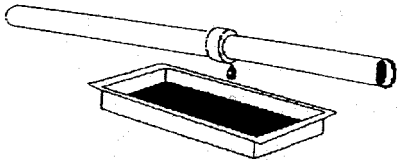
: Capital Costs
■ O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

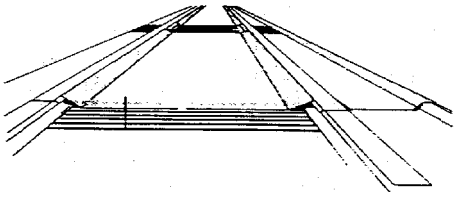
Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Drip Pans

DP



Use Drip Pans for Leaking Equipment



Use Drip Pans in Loading and Unloading Areas

DESCRIPTION:

Drip pans are small depressions or pans used to contain very small volumes of leaks, drips, and spills that occur at a facility. Drip pans can be depressions in concrete, asphalt, or other impenetrable material. They can be made of metal, plastic, or any material that does not react with the dripped chemicals. Drip pans can be temporary or permanent.

Drip pans are used to catch drips from valves, pipes, etc. so that the materials or chemicals can be cleaned up easily or recycled before they contaminate stormwater. Although leaks and drips should be repaired and eliminated as part of a preventative maintenance program, drip pans can provide a temporary solution where repair or replacement must be delayed. In addition, drip pans can be an added safeguard when they are positioned beneath areas where leaks and drips may occur.

APPROACH:

- When using drip pans, consider the location of the drip pan, weather conditions, the type of material used for the drip pan, and how it will be cleaned.
- The location of the drip pan is important. Because drip pans must be inspected and cleaned frequently, they must be easy to reach and remove. However, take special care to avoid placing drip pans where they can be easily overturned or be a safety hazard.
- Secure pans by installing or anchoring them. Drip pans may be placed on platforms, behind wind blocks or tied down.
- Employees must pay attention to the pans and empty them when they are nearly full.
- Frequent inspection of the drip pans is necessary due to the possibility of leaks in the pan itself or in piping or valves that may occur randomly or irregular slow drips that may increase in volume.

LIMITATIONS:

- Contain small volumes only.
- Must be inspected and cleaned frequently.
- Must be secured during poor weather conditions.
- Contents may be disposed of improperly unless facility personnel are trained in proper disposal methods.

APPLICATIONS

: Manufacturing
9 Material Handling
9 Vehicle Maintenance
9 Construction
9 Commercial Activities
9 Roadways
: Waste Containment
9 Housekeeping Practices

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: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
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: Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
9 O&M Costs
■ Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Employee Training

ET

DESCRIPTION:

Employee training, like equipment maintenance, is a method by which to implement BMPs. Employee training should be used in conjunction with all other BMPs as part of the facility's SWPPP.

The specific employee training aspects of each of the source controls are highlighted in the individual information sheets. The focus of this information sheet is more general, and includes the overall objectives and approach for assuring employee training in stormwater pollution prevention. Accordingly, the organization of this information sheet differs somewhat from the other information sheets in this chapter.

OBJECTIVES:

Employee training should be based on four objectives:

< Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater;
< Identify solutions (BMPs);
< Promote employee ownership of the problems and the solutions; and
< Integrate employee feedback into training and BMP implementation.

APPROACH:

< Integrate training regarding stormwater quality management with existing training programs that may be required for other regulations.
< Employee training is a vital component of many of the individual source control BMPs included in this manual.

PROGRAM ELEMENTS

: New Development
: Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
: Illegal Discharges

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IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
9 Regulatory
■ Training
: Staffing
: Administrative

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Hazardous Waste Management

HWM

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

APPLICATION:

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

< Paints and solvents; petroleum products such as oils; fuels and greases; herbicides and pesticides; acids for cleaning masonry; and concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with federal, state and local regulations, including:

< Sandblasting grit mixed with lead, cadmium or chromium based paints, asbestos, and PCBs.

INSTALLATION/APPLICATION CRITERIA:

The following steps will help reduce stormwater pollution from hazardous wastes:

< Use all of the product before disposing of the container.

< Do not remove the original product label, it contains important safety and disposal information.

< Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

LIMITATIONS:

Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste collector.

MAINTENANCE:

< Inspect hazardous waste receptacles and areas regularly.

< Arrange for regular hazardous waste collection.

Materials Adopted From Salt Lake County Engineering Division Guidance Document

PROGRAM ELEMENTS

: New Development
: Residential
: Commercial Activities
: Industrial Activities
: Municipal Facilities
: Illegal Discharges

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9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
: O&M Costs
: Regulatory
: Training
: Staffing
: Administrative

■ High : Medium **9** Low

BMP: Non-Stormwater Discharges To Drains

NSWD

DESCRIPTION:

Eliminate non-stormwater discharges to the stormwater collection system. Non-stormwater discharges may include: process wastewaters, cooling waters, wash waters, and sanitary wastewater.

APPROACH:

The following approaches may be used to identify non-stormwater discharges:

< Visual inspection: the easiest method is to inspect each discharge point during dry weather. Keep in mind that drainage from a storm event can continue for three days or more and groundwater may infiltrate the underground stormwater collection system.

< Piping Schematic Review: The piping schematic is a map of pipes and drainage systems used to carry wastewater, cooling water, sanitary wastes, etc... A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system. Inspect the path of floor drains in older buildings.

< Smoke Testing: Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems. During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

< Dye Testing: A dye test can be performed by simply releasing a dye into either the sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

LIMITATIONS:

< Many facilities do not have accurate, up-to-date schematic drawings.

< Video and visual inspections can identify illicit connections to the storm sewer, but further testing is sometimes required (e.g. dye, smoke) to identify sources.

APPLICATIONS

: Manufacturing
9 Material Handling
: Vehicle Maintenance
9 Construction
: Commercial Activities
9 Roadways
: Waste Containment
: Housekeeping Practices

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Stormwater Permit: 801-963-3318

TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
: Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

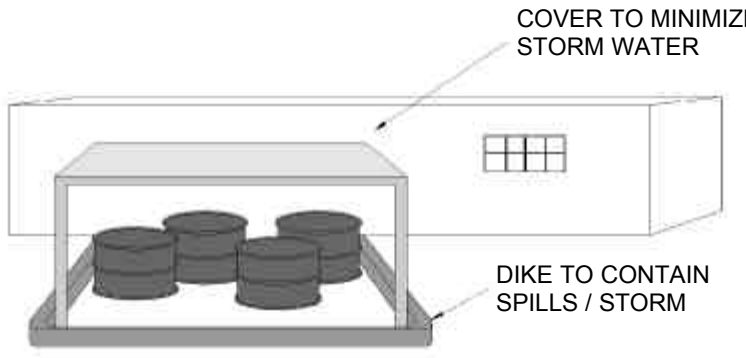
: Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Outdoor Container Storage of Liquids

OCSL



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor container storage areas by installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

APPROACH:

Protect materials from rainfall, runon, runoff, and wind dispersal:

< Store materials indoors.
< Cover the storage area with roof.
< Minimize stormwater runon by enclosing the area or building a berm around it.
< Use a "doghouse" for storage of liquid containers.
< Use covered dumpsters for waste product containers.

Storage of oil and hazardous materials must meet specific federal and state standards including:

< secondary containment,
< integrity and leak detection monitoring, and
< emergency preparedness plans.

Train operator on proper storage.

Safeguards against accidental releases:

< Overflow protection devices to warn operator or automatic shut down transfer pumps, protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage, clear tagging or labeling, and restricting access to valves to reduce human error.

Berm or surround tank or container with secondary containment system:

< Dikes, liners, vaults, or double walled tanks.

Some municipalities require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

LIMITATIONS:

Storage sheds often must meet building and fire code requirements.

MAINTENANCE:

Conduct routine weekly inspections.

APPLICATIONS

9 Manufacturing
: Material Handling
9 Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
: Waste Containment
: Housekeeping Practices

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
: Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
: O&M Costs
: Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Outdoor Loading/Unloading Of Materials

OLUM

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

APPROACH:

< Park tank trucks or delivery vehicles so that spills or leaks can be contained.
< Cover the loading/unloading docks to reduce exposure of materials to rain.
< A seal or door skirt between trailer and building can also prevent exposure to rain.
< Design loading/unloading area to prevent stormwater runon: grade/berm and position roof downspouts to direct stormwater away from loading/unloading areas.
< Contain leaks during transfer.
< Use drip pans under hoses.
< Make sure fork lift operators are properly trained.
< Train employees for spill containment and cleanup.

LIMITATIONS:

< Space and time limitations may preclude all transfers from being performed indoors or under cover.
< It may not be possible to conduct transfers only during dry weather.

MAINTENANCE:

< Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
< Check loading and unloading equipment regularly for leaks: valves, pumps, flanges, and connections.

APPLICATIONS

9 Manufacturing
: Material Handling
9 Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

9 Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

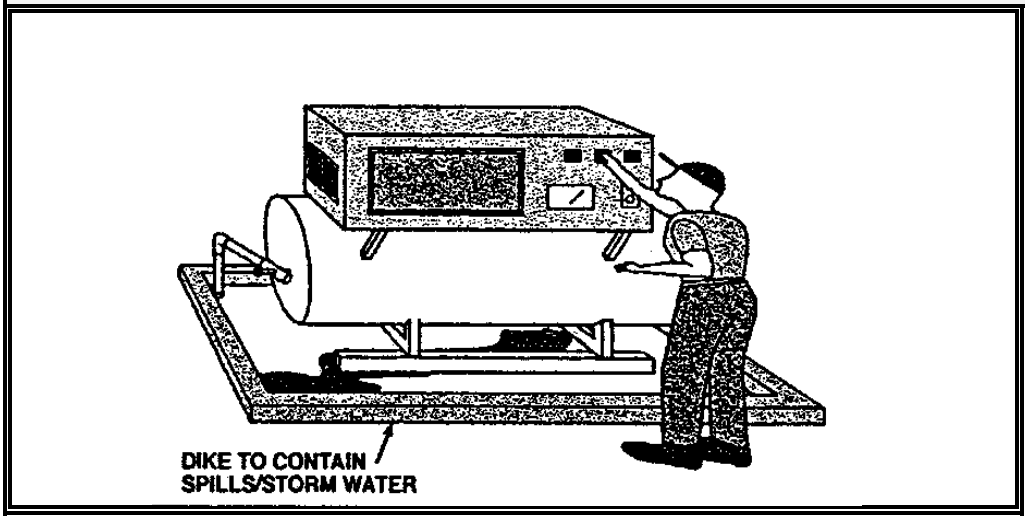
■ Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Outdoor Process Equipment Operations

OPE



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor process equipment operations and maintenance by reducing the amount of waste created, enclosing or covering all or some of the equipment, installing secondary containment, and training employees.

APPROACH:

< Alter the activity to prevent exposure of pollutants to stormwater.
< Move activity indoors.
< Cover the area with a permanent roof.
< Minimize contact of stormwater with outside manufacturing operations through berming and drainage routing (runon prevention).
< Connect process equipment area to public sewer or facility wastewater treatment system.
< Clean the storm drainage system regularly.
< Use catch basin filtration inserts as a means to capture particulate pollutants.
< Some municipalities require that secondary containment areas (regardless of size) be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

LIMITATIONS:

< Providing cover may be expensive.
< Space limitations may preclude enclosing some equipment.
< Storage sheds often must meet building and fire code requirements.

MAINTENANCE:

Routine preventive maintenance, including checking process equipment for leaks.

APPLICATIONS

: Manufacturing
9 Material Handling
: Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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9 Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

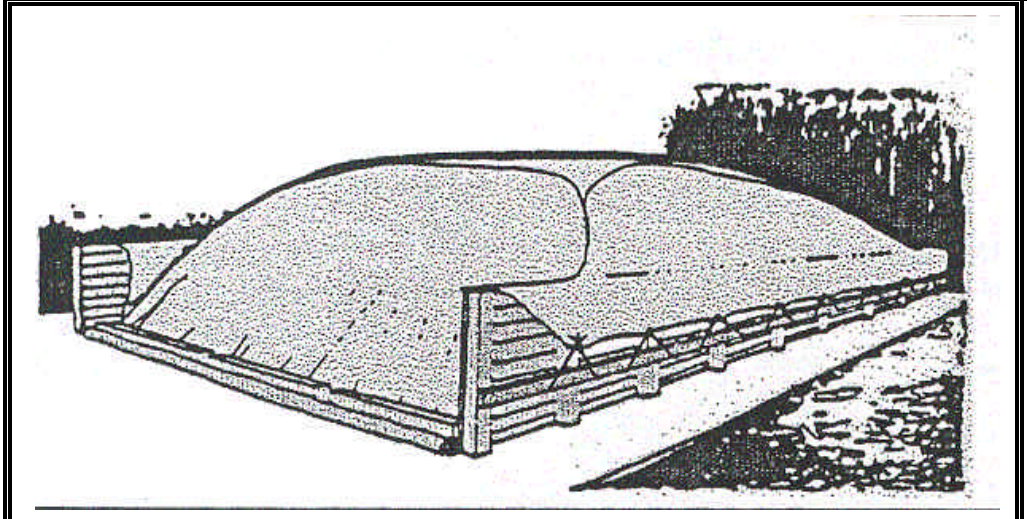
■ Capital Costs
: O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Outdoor Storage of Raw Materials

OSRM



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor materials and product storage areas by enclosing or covering materials, installing secondary containment, and preventing stormwater runon.

APPROACH:

Protect materials from rainfall, runon, runoff and wind dispersal:

- Store material indoors.
- Cover the storage area with a roof.
- Cover the material with a temporary covering made of polyethylene, polypropylene, or hypalon.
- Minimize stormwater runon by enclosing the area or building a berm around the area.
- Use a "doghouse" for storage of liquid containers.

< Parking lots or other surfaces near bulk materials should be swept periodically to remove debris blown or washed from storage area.
< Install pellet traps at stormwater discharge points where plastic pellets are loaded and unloaded.
< Keep liquids in a designated area on a paved impervious surface within a secondary containment.
< Keep outdoor storage containers in good condition.
< Use berms and curbing.
< Use catch basin filtration inserts.

LIMITATIONS:

< Space limitations may preclude storing some materials indoors.
< Some municipalities require that secondary containment areas (regardless of size) be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
< Storage sheds often must meet building and fire code requirements.

MAINTENANCE:

Berm and curbing repair and patching.

APPLICATIONS

: Manufacturing
: Material Handling
9 Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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■ Toxic Materials
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■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

: Capital Costs
9 O&M Costs
: Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Signs and Labels

SL

DESCRIPTION:

Signs and labels identify problem areas or hazardous materials at a facility. Warning signs, often found at industrial facilities, are a good way to suggest caution in certain areas. Signs and labels can also provide instructions on the use of materials and equipment. Labeling is a good way to organize large amounts of materials, pipes, and equipment, particularly on large sites.

APPROACH:

Signs and labels can be used at all types of facilities. Areas where they are particularly useful are material transfer areas, equipment areas, loading and unloading areas, or anywhere information might prevent contaminants from being released to stormwater.

Signs and labels should be visible and easy to read. Useful signs and labels might provide the following information:

- < Names of facility and regulatory personnel, including emergency phone numbers, to contact in case of an accidental discharge, spill, or other emergency.
- < Proper uses of equipment that could cause release of stormwater contaminants.
- < Types of chemicals used in high-risk areas.
- < The direction of drainage lines/ditches and their destination (treatment or discharge).
- < Information on a specific material.
- < Refer to OSHA standards for sizes and numbers of signs required for hazardous material labeling.

LIMITATIONS:

No limitations.

MAINTENANCE:

- < Periodic checks can ensure that signs are still in place and labels are properly attached.
- < Signs and labels should be replaced and repaired as often as necessary.

APPLICATIONS

: Manufacturing
9 Material Handling
9 Vehicle Maintenance
9 Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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: Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

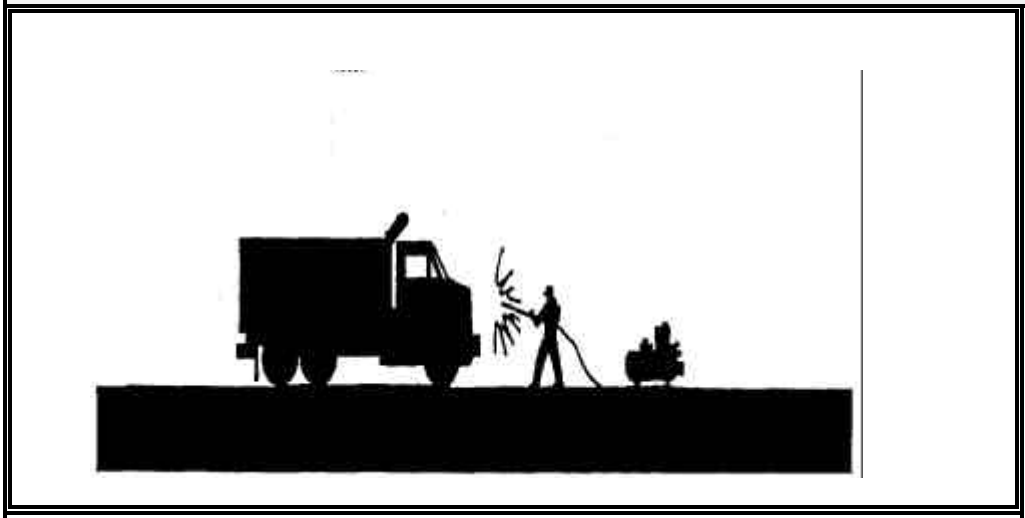
9 Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Vehicle And Equipment Cleaning

VEC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment washing and steam cleaning by using off-site facilities, washing in designated, contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and training employees and subcontractors.

APPROACH:

< Use off-site commercial washing and steam cleaning businesses as much as possible. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute stormwater. If you wash a large number of vehicles or pieces of equipment, consider conducting this work at an off-site commercial business. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work off-site can also be economical by eliminating the need for a separate washing operation at your site.

< If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with stormwater, creeks, rivers, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground.

< Use as little water as possible to avoid having to install erosion and sediment controls for the wash area. Use phosphate-free biodegradable soaps. Educate employees and subcontractors on pollution prevention measures. Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations.

LIMITATIONS:

< Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.

< Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance.(See BMP in the Construction Section).

< The measures outlined in this fact sheet are insufficient to address all the environmental impacts and compliance issues related to steam cleaning.

MAINTENANCE:

< Minimal, some berm repair may be necessary.

Materials Adopted From Salt Lake County Engineering Division Guidance Document

APPLICATIONS

9 Manufacturing
9 Material Handling
: Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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TARGETED POLLUTANTS

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: Medium Impact
9 Low or Unknown Impact

■ Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

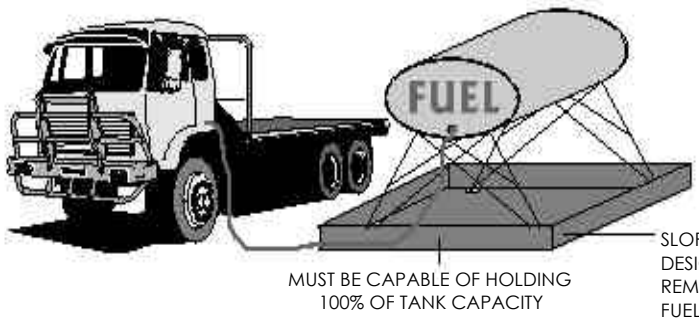
IMPLEMENTATION REQUIREMENTS

: Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

BMP: Vehicle And Equipment Fueling

VEF



DESCRIPTION:

Prevent fuel spills and leaks, and reduce their impacts to stormwater by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

APPROACH:

< Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute stormwater. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.

< If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.

< Discourage"topping-off" of fuel tanks.

< Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks. Place a stockpile of spill cleanup materials where it will be readily accessible. Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.

< Carry out all federal and state requirements regarding stationary above ground storage tanks. Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time. Train employees and subcontractors in proper fueling and cleanup procedures.

LIMITATIONS:

Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance (See BMP sheet in Construction section).

MAINTENANCE:

< Keep ample supplies of spill cleanup materials on-site.

< Inspect fueling areas and storage tanks on a regular schedule.

APPLICATIONS

9 Manufacturing
: Material Handling
: Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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9 Nutrients
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■ Toxic Materials
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■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

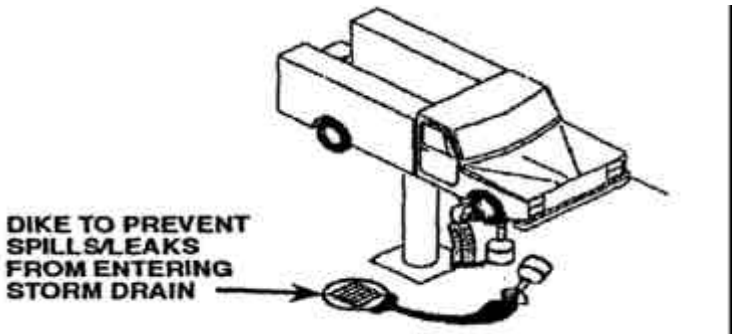
: Capital Costs
9 O&M Costs
: Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Vehicle And Equipment Maintenance & Repair

VEMR



(INSIDE MAINTENANCE FACILITY)

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from vehicles and equipment maintenance and repair by running a dry shop.

APPROACH:

< Keep equipment clean, don't allow excessive build-up of oil and grease.
< Keep drip pans or containers under the areas that might drip.
< Do not change motor oil or perform equipment maintenance in non-appropriate areas.
< Inspect equipment for leaks on a regular basis.
< Segregate wastes.
< Make sure oil filters are completely drained and crushed before recycling or disposal.
< Make sure incoming vehicles are checked for leaking oil and fluids.
< Clean yard storm drain inlets regularly and especially after large storms.
< Do not pour materials down drains or hose down work areas; use dry seeping.
< Store idle equipment under cover.
< Drain all fluids from wrecked vehicles.
< Recycle greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.
< Switch to non-toxic chemicals for maintenance when possible.
< Clean small spills with rags, general clean-up with damp mops and larger spills with absorbent material.
< Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
< Train employees, minimize use of solvents.

LIMITATIONS:

< Space and time limitations may preclude all work being conducted indoors.
< It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours.
< Dry pans are generally too small to contain antifreeze, which may gush from some vehicles, so drip pans may have to be purchased or fabricated.
< Dry floor cleaning methods may not be sufficient for some spills.

MAINTENANCE:

Should be low if procedures for the approach are followed.

APPLICATIONS

9 Manufacturing
: Material Handling
: Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
9 Waste Containment
: Housekeeping Practices

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TARGETED POLLUTANTS

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: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
■ Heavy Metals
■ Toxic Materials
9 Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

9 Capital Costs
: O&M Costs
: Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Waste Handling And Disposal

WHD

DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from waste handling and disposal by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, re-use, and recycling; and preventing runon and runoff from waste management areas.

APPROACH:

< Maintain usage inventory to limit waste generation.
< Substitute or eliminate raw materials.
< Modify process or equipment.
< SARA Title III, Section 313 requires reporting for over 300 listed chemicals and chemical compounds. This requirement should be used to track these chemicals although this is not as accurate a means of tracking as other approaches.
< Track waste generated.
< Use design data and review: process flow diagram, materials and applications diagram, piping and instructions, equipment list, plot plan.
< Use economic data and review: Waste treatment and disposal cost. Product utility and economic cost. Operation and maintenance labor cost.
< Recycle materials whenever possible.
< Maintain list of and the amounts of materials disposed.
< Segregation and separate waste.
< Cover, enclose, or berm industrial wastewater management areas whenever possible to prevent contact with runon or runoff.
< Equip waste transport vehicles with anti-spill equipment.
< Minimize spills and fugitive losses such as dust or mist from loading systems.
< Ensure that sediments or wastes are prevented from being tracked off-site.
< Training and supervision.
< Stencil storm drains on the facility's property with prohibitive message regarding waste disposal.

LIMITATIONS:

Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.

APPLICATIONS

9 Manufacturing
: Material Handling
9 Vehicle Maintenance
: Construction
: Commercial Activities
9 Roadways
: Waste Containment
: Housekeeping Practices

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■ Heavy Metals
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9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

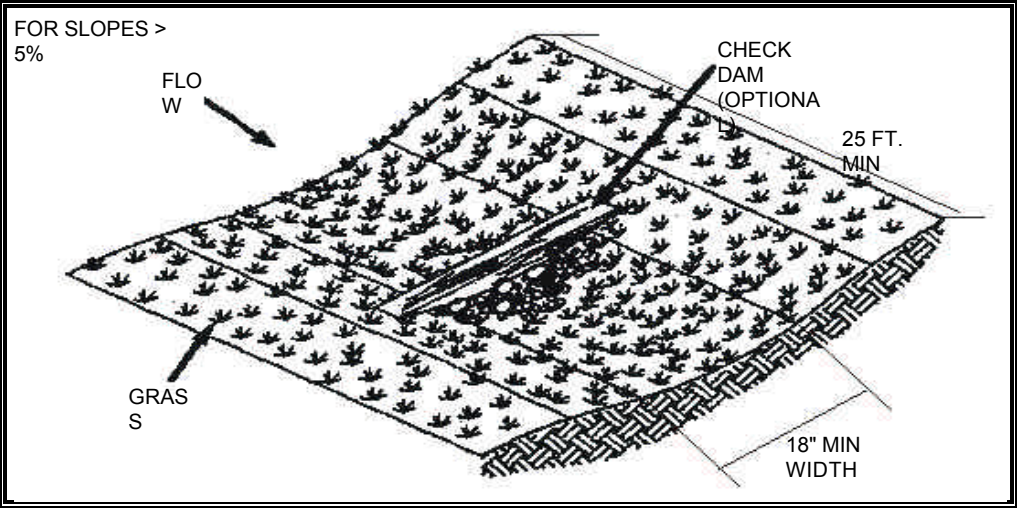
9 Capital Costs
: O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Biofilters

BF



DESCRIPTION:

Biofilters are of two types: swale and strip. A swale is a vegetated channel that treats concentrated flow. A strip treats sheet flow and is placed parallel to the contributing surface.

APPLICATION:

Suitable for small catchment areas of a few acres.

INSTALLATION/APPLICATION CRITERIA:

< Comparable performance to wet ponds and constructed wetlands.
< Limited to treating a few acres and availability of water during dry season.
< The surface area must be defined.
< The minimum width for a swale is determined by Manning's Equation.
< Minimum length of a strip is 10 feet.
< The longitudinal slope must not exceed 5%.
< Use a flow spreader and energy dissipator at the entrance of a swale.
< Good soils are important to achieve good vegetation cover.

LIMITATIONS:

< Poor performance has occurred but this appears to be due to poor design.
< May be limited to areas where summer irrigation is feasible.
< Can be difficult to maintain sheet flow in strips.
< Can be difficult to avoid channelization in swales.
< Cannot be placed on steep slope.
< Area required may make infeasible on industrial sites.
< Proper maintenance required to maintain health and density of vegetation.

MAINTENANCE:

< Make sure soils are suitable for healthy vegetation.
< Level cross-section and even longitudinal slope for swales.
< Achieve sheet flow with strips.

CONSIDERATIONS

: Soils
: Area Required
: Slope
: Water Availability
: Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

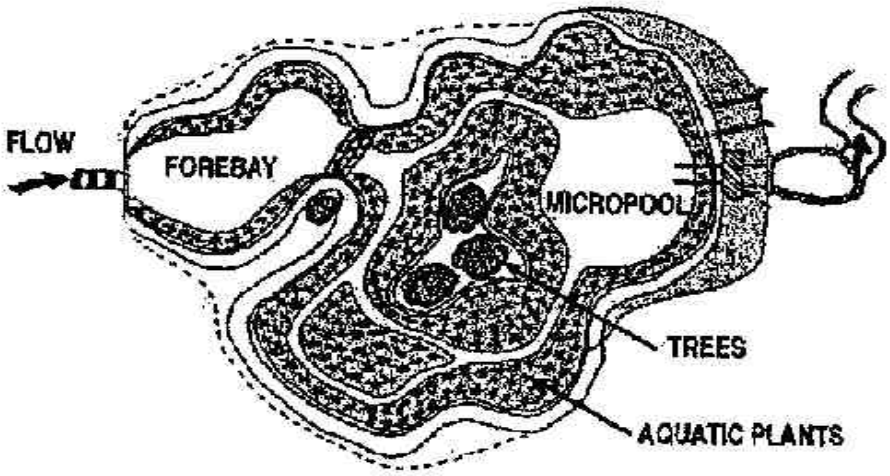
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Constructed Wetlands

CW



DESCRIPTION:

Constructed wetlands have a significant percentage of the facility covered by wetland vegetation.

APPLICATION:

< Need to achieve high level of particulate and some dissolved contaminant removal.
< Ideal for large, regional tributary areas.
< Multiple benefits of passive recreation and wildlife.

INSTALLATION/APPLICATION CRITERIA:

< Suitable soils for wetland vegetation are required.
< Surface area equal to at least 1% and preferably 2% of the tributary watershed.
< Involve qualified wetland ecologist to design and install wetland vegetation.
< Establishing wetland vegetation may be difficult.

LIMITATIONS:

< Concern for mosquitos.
< Cannot be placed on steep unstable slopes.
< Need base flow to maintain water level.
< Not feasible in densely developed areas.
< Nutrient release may occur during winter.
< Overgrowth can lead to reduced hydraulic capacity.
< Regulatory agencies may limit water quality to constructed wetlands.

MAINTENANCE:

< Remove foreign debris and sediment build-up.
< Areas of bank erosion should be repaired.
< Remove nuisance species.
< Control mosquitoes.

CONSIDERATIONS

: Soils
: Area Required
: Slope
: Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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IMPLEMENTATION REQUIREMENTS

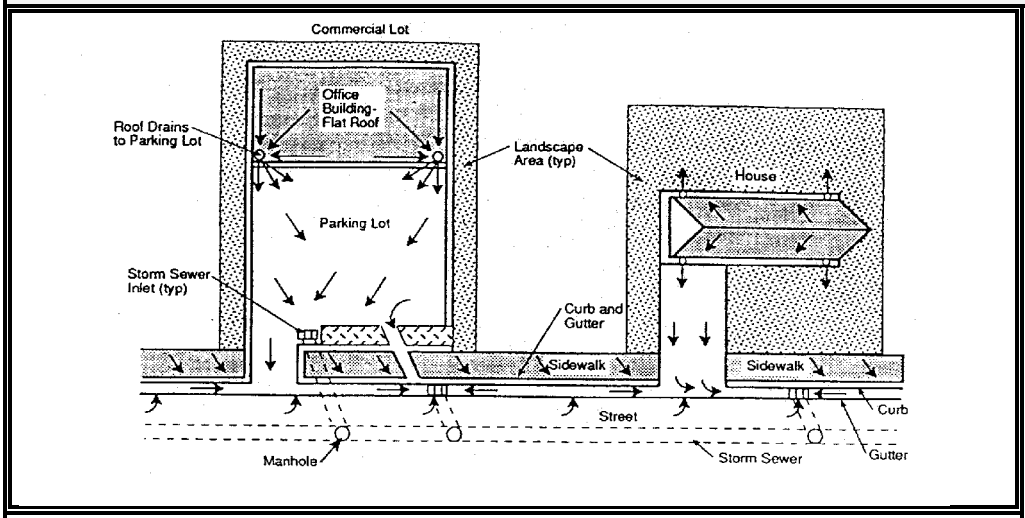
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Minimizing DCIAs

DCIA



DESCRIPTION:

Minimizing directly connected impervious areas (DCIAs) is a structural BMP strategy that requires a basic change in drainage design philosophy. The basic principle is to direct stormwater runoff to landscaped areas, grass buffer strips, and vegetated swales to slow down the rate of runoff, reduce runoff volumes, attenuate peak flows, and encourage filtering and infiltration of stormwater.

APPLICATION:

It can be made an integral part of drainage planning for any development.

INSTALLATION/APPLICATION CRITERIA:

< Use on sites with general terrain slopes flatter than 3-4%.
< Design the site drainage flowpath to maximize flow over vegetated areas before leaving a site.
< Minimize ground slopes to limit erosion and slow down water flow.
< Select vegetation that will not only survive, but also enhance water quality.

LIMITATIONS:

< Potential increase in site open space requirements over the traditional development systems.
< Introduction of a nonconventional development design strategy.
< Infiltration of water near building foundations and parking lots is a concern.
< Will likely result in increased maintenance along the swales.

MAINTENANCE:

< Maintain grass and other vegetation.
< Pick up debris.
< Conduct ongoing inspections for potential erosion problems and changes in drainage patterns.
< Remove sediment buildup and replace damaged grass cover.

CONSIDERATIONS

9 Soils
9 Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
: Heavy Metals
9 Toxic Materials
9 Oxygen Demanding Substances
9 Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

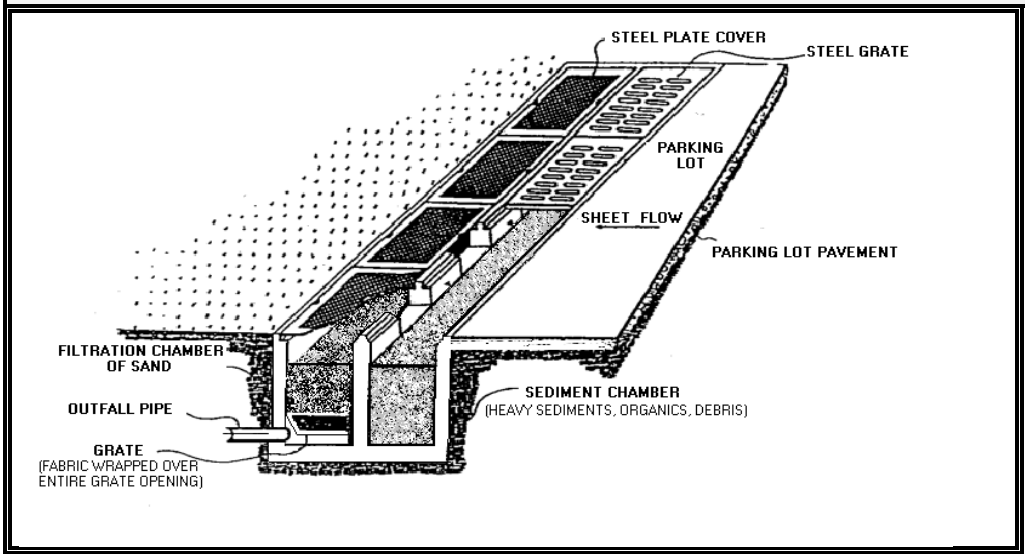
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Double Trench Sand Filter

DTSF



DESCRIPTION:

The double trench sand filter (AKA Delaware sand filter) is a BMP consisting of parallel sedimentation and sand filter trenches connected by a series of level weir notches to assure sheet flow onto the filter. Filtered runoff is conveyed to a storm sewer by gravity flow or by pumping.

APPLICATION:

< Commercial and institutional parking lots, small shopping centers, infill developments.
< Smaller redevelopment sites where the use of conventional BMPs is not practical.

INSTALLATION/APPLICATION CRITERIA:

< Requires very little hydraulic head.
< Need to consider structural design with traffic load.

LIMITATIONS:

< Will not prevent small floatable debris from entering through the grate openings.
< Disposing of petroleum-contaminated sand may require expertise in hazardous waste disposal.
< Sand filter may clog sooner than other BMPs requiring more frequent maintenance.

MAINTENANCE:

< System should be inspected yearly and after storm events to assess the filtration capacity of the filter.
< Filter sand should be replaced every few years to maintain pollutant removal efficiency.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head

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: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

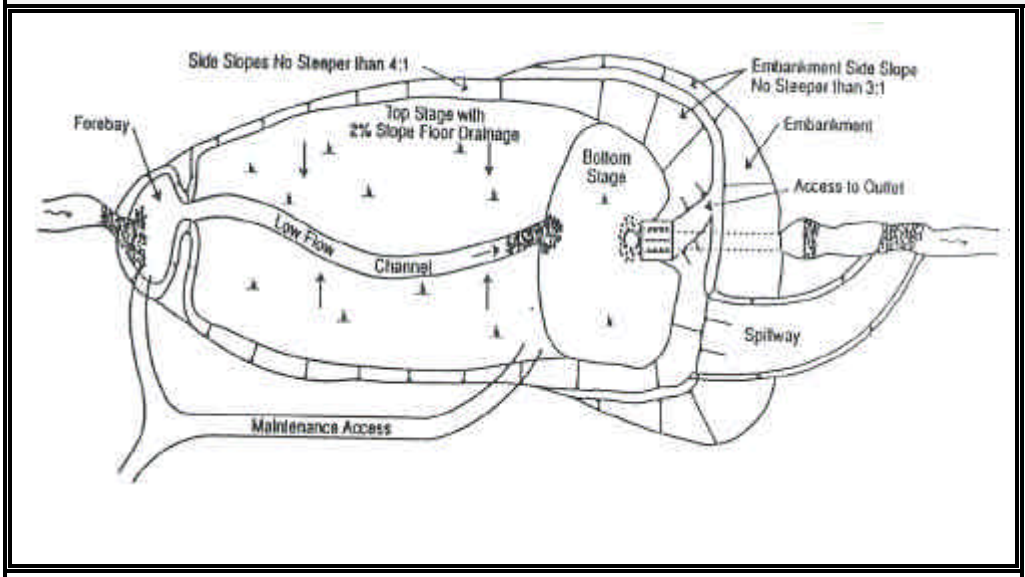
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Extended Detention Basins

EDB



DESCRIPTIONS:

Extended detention basins are dry between storms. During a storm the basin fills. A bottom outlet releases the stormwater slowly to provide time for sediments to settle.

APPLICATION:

< Objective is to remove only particulate pollutants.
< Use where lack of water prevents the use of wet ponds, wetlands or biofilters.
< Use where wet ponds or wetlands would cause unacceptable mosquito conditions.

INSTALLATION/APPLICATION CRITERIA:

< Basin volume is sized to capture a particular fraction of the runoff.
< Drawdown time of 24 to 40 hours.
< Shallow basin with large surface area performs better than deep basin with same volume.
< Place energy dissipators at the entrance to minimize bottom erosion and resuspension.
< Vegetate side slopes and bottom to the maximum extent practical.
< If side erosion is particularly severe, consider paving or soil stabilization.
< If floatables are a problem, protect outlet with trash rack or other device.
< Provide bypass or pass through capabilities for 100-year storm.

LIMITATIONS:

< May be less reliable than other treatment control BMPs. Inability to vegetate banks and bottom may result in erosion and resuspension.
< Limitation of the orifice diameter may preclude use in small watersheds.
< Requires differential elevation between inlet and outlet.

MAINTENANCE:

< Check outlet regularly for clogging.
< Check banks and bottom of basin for erosion and correct as necessary.
< Remove sediment when accumulation reaches 6-inches, or if resuspension is observed.

CONSIDERATIONS

9 Soils
: Area Required
9 Slope
9 Water Availability
: Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
: Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

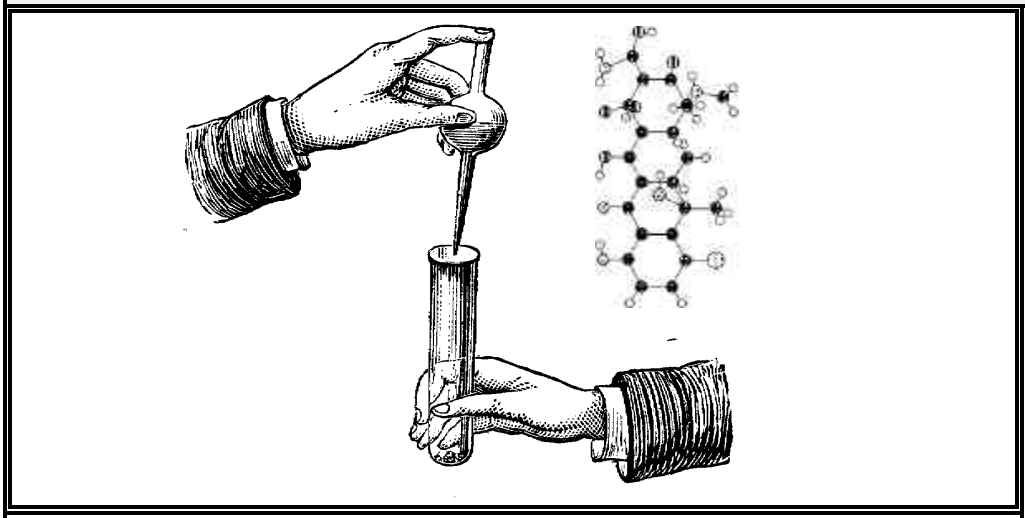
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Gelling Agents

GA



DESCRIPTION:

Gelling agents are materials that interact with liquids either physically or chemically (i.e., thickening or polymerization). Some of the typical gelling agents are polyelectrolyes, polyacrylamide, butylstyrene copolymers, polyacrylonitrile, polyethylene oxide, and a gelling agent referred to as the universal gelling agent which is a combination of these synthetics.

APPLICATION:

Gelling agents are useful for facilities with significant amounts of liquid materials stored onsite.

INSTALLATION/APPLICATION CRITERIA:

- < The use of gels simply involves the addition of the gel to the area of the spill, mixing well, and allowing the mass to congeal.
- < Personnel need to know the properties of the spilled material so that they can choose the correct gel.
- < To prevent the movement of spilled materials, gelling agents must be applied immediately after the spill.
- < Ultimately, the congealed mass will need to be cleaned up by manual or mechanical methods and disposed of properly.

MAINTENANCE:

No information available.

LIMITATIONS:

- < May require knowledge of the spilled materials to select correct gelling agents.
- < May be difficult to clean up
- < May create disposal problems and increase disposal costs by creating a solid waste and potentially a hazardous waste.
- < Gels cannot be used to clean up spills on surface water unless authorized by the U.S. Coast Guard or EPA Regional Response Team.

CONSIDERATIONS

9 Soils
9 Area Required
9 Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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: Medium Impact
9 Low or Unknown Impact

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: Heavy Metals
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: Oxygen Demanding Substances
: Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

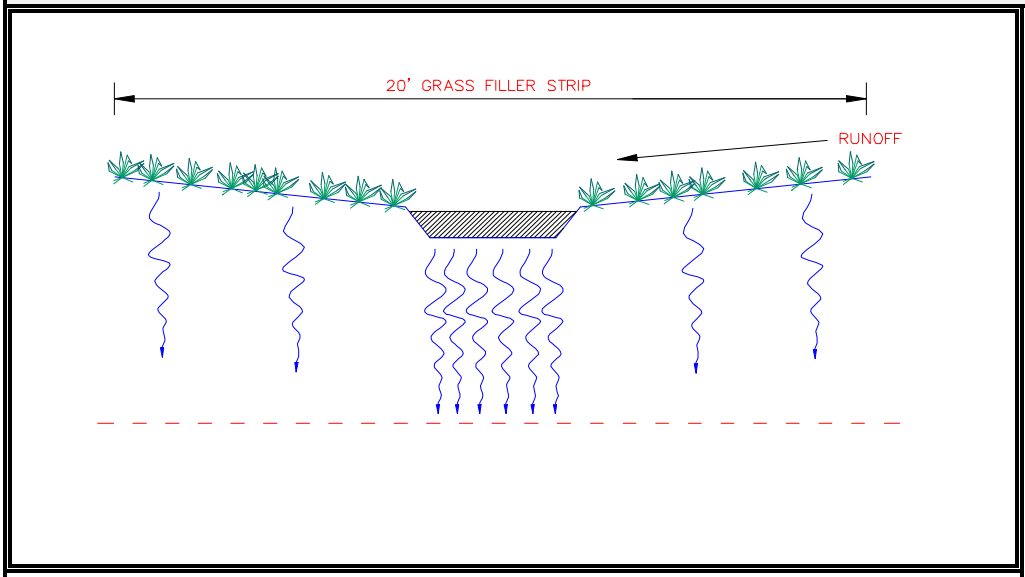
: Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Infiltration

IN



DESCRIPTION:

A family of systems in which the majority of the runoff from small storms is infiltrated into the ground rather than discharged to a surface water body. Infiltration systems include: ponds, vaults, trenches, dry wells, porous pavement, and concrete grids.

APPLICATION:

< Need to achieve high level of particulate and dissolved pollutant removal.
< Suitable site soils and geologic conditions; low potential for long-term erosion in the watershed.
< Multiple management objectives (e.g., ground water recharge or runoff volume control).

INSTALLATION/APPLICATION CRITERIA:

< Volume sized to capture a particular fraction of annual runoff.
< Pretreatment in fine soils.
< Emergency overflow or bypass for larger storms.
< Observation well in trenches.

LIMITATIONS:

< Loss of infiltrative capacity and high maintenance cost in fine soils.
< Low removal of dissolved pollutants in very coarse soils.
< Not suitable on fill sites or steep slopes.
< Risk of ground water contamination in very coarse soils, may require ground water monitoring.
< Should not use until upstream drainage area is stabilized.
< Infiltration facilities could fall under regulations regarding waste disposal to land.

MAINTENANCE:

< Remove sediment at frequency appropriate to avoid excessive concentrations of pollutants and loss of infiltrative capacity.
< Frequent cleaning of porous pavements.
< Maintenance is difficult and costly for underground trenches.

CONSIDERATIONS

: Soils
: Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
: Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
■ Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

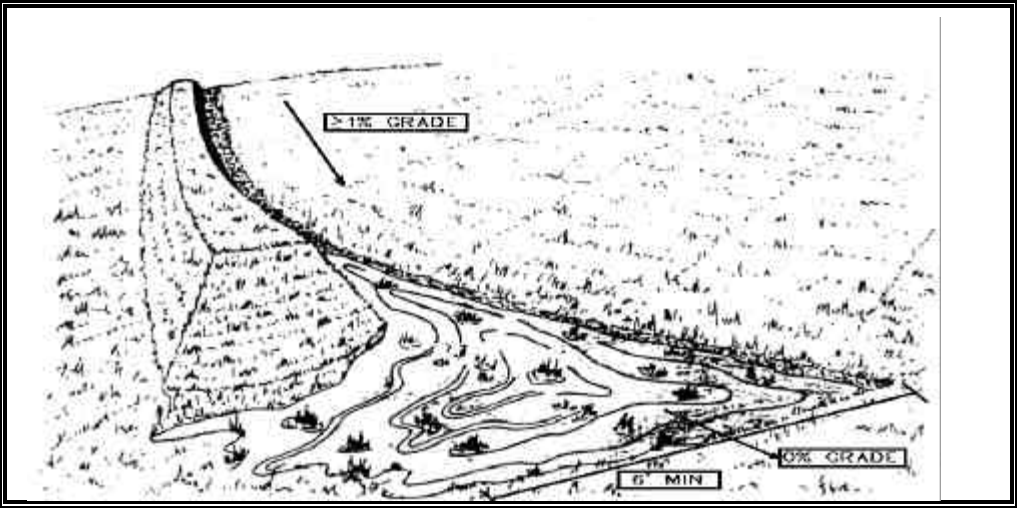
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Level Spreaders

LS



DESCRIPTION:

Level spreaders are devices used at stormwater outlets to spread out collected stormwater flows into sheetflow (runoff that flows over ground surface in a thin, even layer). Typically, a level spreader consists of a depression in the soil surface that spreads the flow onto a flat area across a gentle slope. Level spreaders then release the stormwater flow onto level areas stabilized by vegetation to reduce speed and increase infiltration.

APPLICATION:

Level spreaders are most often used as an outlet for temporary or permanent stormwater conveyances or dikes. Runoff that contains high sediment loads should be treated in a sediment trapping device prior to release into a level spreader.

INSTALLATION/APPLICATION CRITERIA:

< The length of the spreader depends upon the amount of water that flows through the conveyance.
< Larger volumes of water need more space to even out.
< Level spreaders are generally used with filter strips (see Filter Strips BMP).
< The depressions are seeded with vegetation (see Permanent & Temporary Seeding BMP).
< Level spreaders should be constructed on natural soils and not on fill material.
< The entrance to the spreader should be level so that the flow can spread out evenly.

LIMITATIONS:

< Can easily develop "short circuiting" (concentration of flows into small streams instead of sheetflow over the spreader) because of erosion or other disturbance.
< Cannot handle large quantities of sediment-laden stormwater.

MAINTENANCE:

< The spreader should be inspected after every storm event to check for damage.
< If ponding or erosion channels develop, the spreader should be regraded.
< Dense vegetation should be maintained and damaged areas reseeded as needed.

CONSIDERATIONS

: Soils
: Area Required
: Slope
9 Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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TARGETED POLLUTANTS

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: Medium Impact
9 Low or Unknown Impact

: Sediment
: Nutrients
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9 Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

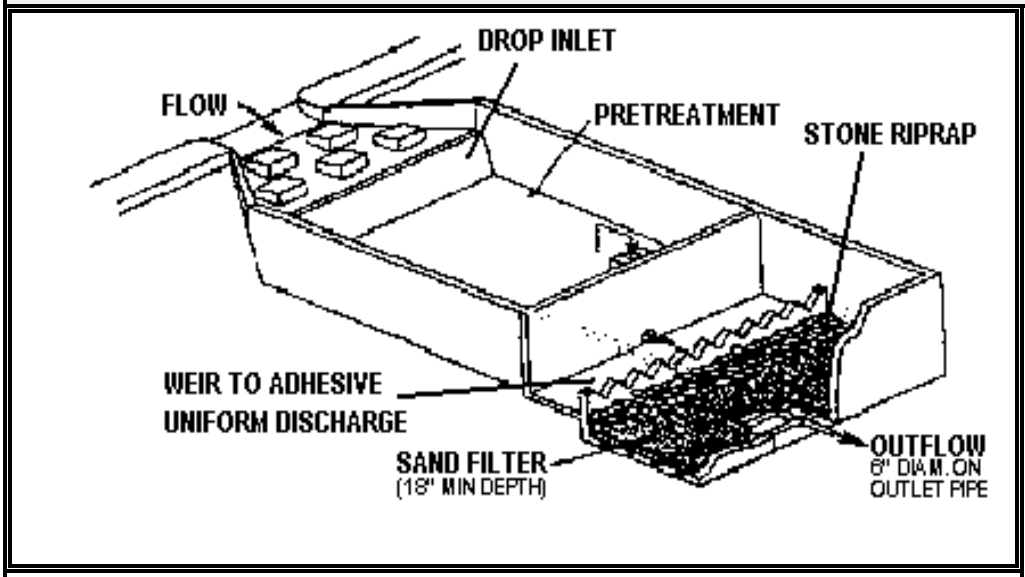
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Media Filtration

MF



DESCRIPTION:

Consists of a settling basin followed by a filter. The most common filter media is sand; some use a peat/sand mixture.

APPLICATION:

< Objective is to remove only sediment (particulate pollutants).
< Use where unavailability of water prevents the use of wet ponds, wetlands, or biofilters.
< Can be placed underground.
< Suitable for individual developments and small tributary areas up to about 100 acres.
< May require less space than other treatment control BMPs.

INSTALLATION/APPLICATION CRITERIA:

< Settling basin smaller than wet or extended detention basin.
< Spread flow across filter.
< Place filter offline to protect from extreme events.
< Minimize erosion in settling basin.

LIMITATIONS:

< Filter may require more frequent maintenance than most of the other BMPs.
< May experience significant head loss.
< Dissolved pollutants are not captured by sand.
< Severe clogging potential if exposed soil surfaces exist upstream.

MAINTENANCE:

Clean filter surface twice annually; or more often if watershed is excessively erosive.

CONSIDERATIONS

9 Soils
9 Area Required
9 Slope
9 Water Availability
9 Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

Sediment
: Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

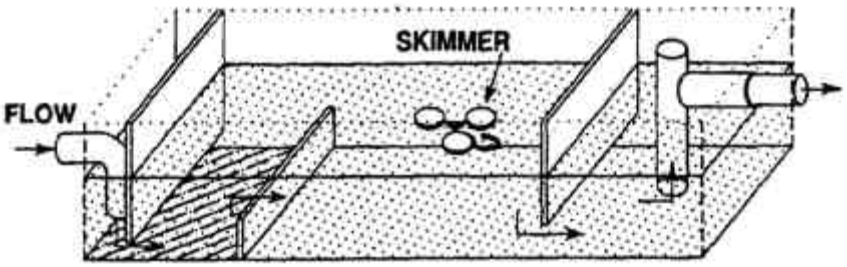
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Oil/Water Separators And Water Quality Inlets

OWS



DESCRIPTION:

Oil/Water separators are designed to remove specific contaminants: petroleum compounds and grease. However, separators will also remove floatable debris and settleable solids. Two general types of oil/water separators are used: conventional gravity separator and the coalescing plate interceptor (CPI).

APPLICATION:

- Applicable to situations where the concentration of oil and grease related compounds will be abnormally high and source control cannot provide effective control. The general types of businesses where this situation is likely are truck, car and equipment maintenance and washing businesses, as well as businesses that perform maintenance on their own equipment and vehicles.
- Public facilities where separators may be required include marine ports, airfields, fleet vehicle maintenance and washing facilities, and mass transit park-and-ride lots.
- Conventional separators are capable of removing oil droplets with diameters equal to greater than 150 microns.
- CPI separators should be used if smaller droplets must be removed.

INSTALLATION/APPLICATION CRITERIA:

- Sizing related to anticipated influent oil concentration, water temperature and velocity, and the effluent goal.
- To maintain reasonable separator size, it should be designed to bypass flows in excess of first flush.

LIMITATIONS:

- Little data on oil characteristics in stormwater leads to considerable uncertainty about performance.
- Air quality permit may be required.

MAINTENANCE:

Clean frequently of accumulated oil, grease, and floating debris.

CONSIDERATIONS

9 Soils
: Area Required
9 Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

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: Medium Impact
9 Low or Unknown Impact

: Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

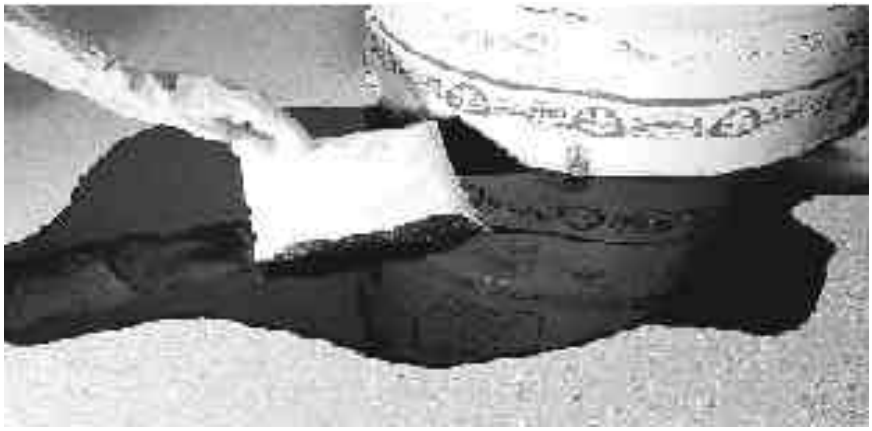
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Sorbents

SO



DESCRIPTION:

Sorbents are materials that are capable of cleaning up spills through the chemical processes of adsorption and absorption. Sorbents adsorb (an attraction to the outer surface of a material) or absorb (taken in by the material like a sponge) only when they come in contact with the sorbent materials.

Sorbents include, but are not limited to, the following:

< Common materials such as clays, sawdust, straw and fly ash
< Polymers - polyurethane and polyolefin
< Activated Carbon - powdered or granular
< "Universal Sorbent Material" - a silicate glass foam consisting of rounded particles that can absorb the material.

APPLICATION:

Sorbents are useful BMPs for facilities with liquid materials onsite.

INSTALLATION/APPLICATION CRITERIA:

< Personnel should know the properties of the spilled material(s) to know which sorbent is appropriate. To be effective, sorbents must adsorb the material spilled but must not react with the spilled material to form hazardous or toxic substances.
< Apply immediately to the release area.
< Application is generally simple: the sorbent is added to the area of release, mixed well, and allowed to adsorb or absorb.
< Many sorbents are not reusable once they have been used.
< Proper disposal is required.

LIMITATIONS:

< Requires a knowledge of the chemical makeup of a spill (to choose the best sorbent).
< May be an expensive practice for large spills.
< May create disposal problems and increase disposal costs by creating a solid waste and potentially a hazardous waste.

MAINTENANCE:

No information available.

Materials Adopted From Salt Lake County Engineering Division Guidance Document

CONSIDERATIONS

9 Soils
9 Area Required
9 Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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: Medium Impact
9 Low or Unknown Impact

9 Sediment
9 Nutrients
: Heavy Metals
■ Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

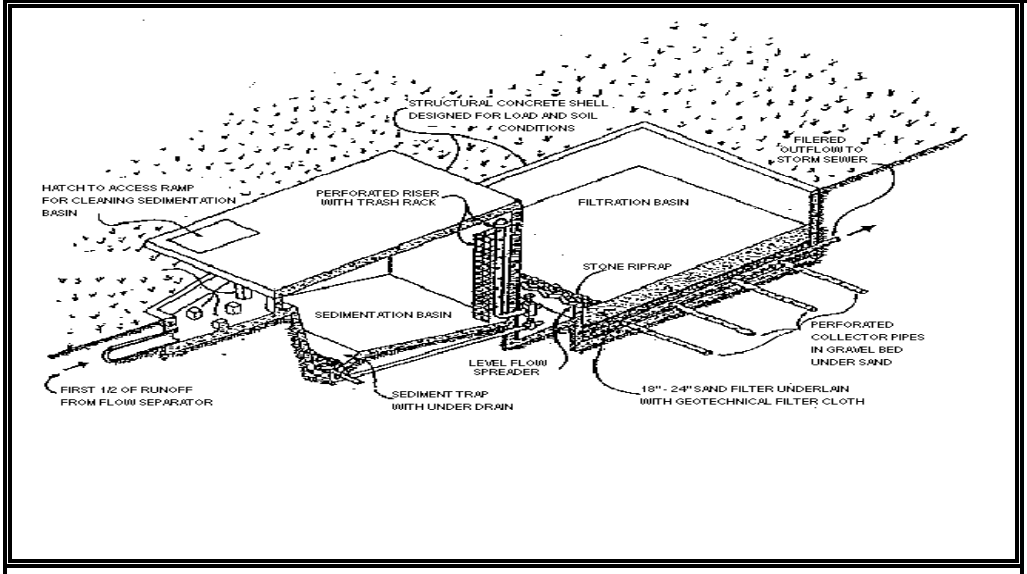
IMPLEMENTATION REQUIREMENTS

: Capital Costs
9 O&M Costs
9 Maintenance
: Training

■ High **:** Medium **9** Low

BMP: Surface Sand Filter System

SSFS



DESCRIPTION:

The surface sand filter system (aka Austin sand filter) consists of a sedimentation chamber or pond followed by a surface sand filter with collector under drains in a gravel bed. Filtered runoff is conveyed to a storm sewer or channel by gravity flow or by pumping.

APPLICATION:

< Commercial and institutional parking lots, small shopping centers, and infill development.
< Smaller redevelopment sites where the use of conventional BMPs is not practical.

INSTALLATION/APPLICATION CRITERIA:

< Filter bed chambers that are too shallow could freeze, causing the filter to become ineffective.
< Pretreatment may be necessary to protect the filter media from excessive sediment loading.
< System should be designed for easy maintenance.

LIMITATIONS:

< Sites with little to no gradient may prevent sufficient gravity flow through the system.
< Extended periods of cold weather could affect pollutant removal efficiency.

MAINTENANCE:

< System should be inspected yearly and after storm events to assess the filtration capacity of the filter.
< Filter sand should be replaced every few years to maintain pollutant removal efficiency.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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: Medium Impact
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: Nutrients
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: Oxygen Demanding Substances
■ Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

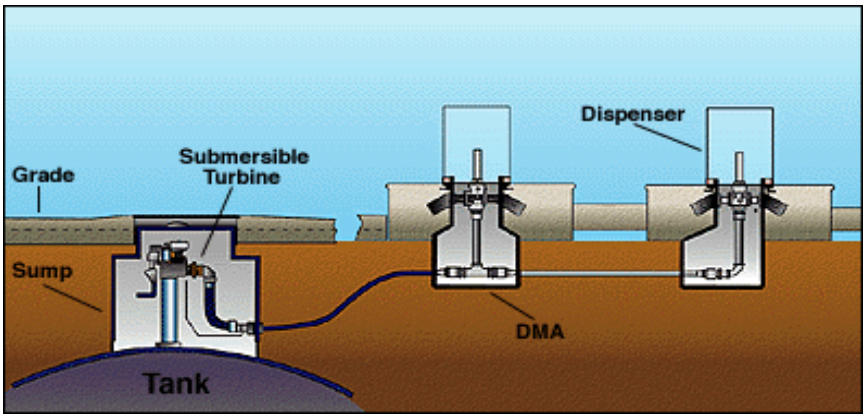
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Sumps

S



DESCRIPTION:

Sumps are holes or low areas that are structured so that liquid spills or leaks will flow down toward a particular part of a containment area. Frequently, pumps are placed in a depressed area and are turned on automatically to transfer liquids away from the sump when the level of liquids gets too high. Sumps can be temporary or permanent.

APPLICATION:

Sumps can be used at all facilities. Sumps are used with other spill containment and treatment measures and can be located almost anywhere onsite. Sumps are frequently located in low lying areas within handling or storage areas.

INSTALLATION/APPLICATION CRITERIA:

< Consider the pump location, function, and system alarms when designing a sump system.
< Design and install the sump in the lowest lying area of a containment structure, allowing materials to gather in the area of the sump.
< Construct the sump of impenetrable materials and provide a smooth surface so that liquids are funneled toward the sump.
< It may be appropriate to house the pumps in a shed or other structure for protection and stabilization.

LIMITATIONS:

< Pumps may clog easily if not designed correctly.
< Costs for purchasing and/or replacing pumps may be high.

MAINTENANCE:

Where pumps are used, frequent inspection and maintenance should be performed. It may require a maintenance/servicing agreement with the pump dealers.

CONSIDERATIONS

9 Soils
9 Area Required
9 Slope
9 Water Availability
9 Aesthetics
: Hydraulic Head
9 Environmental Side Effects

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: Nutrients
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9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

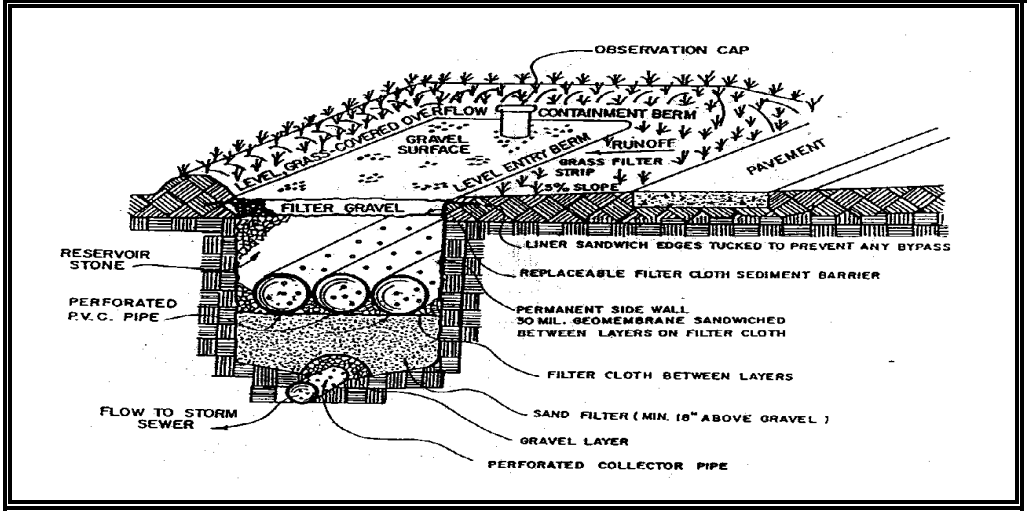
: Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Trench Sand Filter System

TSFS



DESCRIPTION:

An adaptation of the surface sand filter system. The trench sand filter system has two variations. One variation consists of a trench sand filter system with a stone reservoir. The other variation consists of a trench sand filter system with a small sedimentation pond.

APPLICATION:

Townhouse developments or small commercial redevelopments.

INSTALLATION/APPLICATION CRITERIA:

< Topography should offer sufficient relief to allow the system to function by gravity flow.
< Design for easy maintenance accessibility.
< Design for safety barriers which prevent children from entering the sedimentation pond.

LIMITATIONS:

< Sites with little or no gradient may prevent sufficient gravity flow through the systems.
< Not recommended for parking lots.

MAINTENANCE:

< Stone reservoirs will require periodic replacement of the upper filter cloth and gravel layer.
< Sedimentation ponds will require periodic removal of accumulated sediment.

CONSIDERATIONS

: Soils
9 Area Required
: Slope
9 Water Availability
9 Aesthetics
9 Hydraulic Head
9 Environmental Side Effects

West Valley City Stormwater Utility
West Valley City Engineering Division
3600 Constitution Blvd. Room 280
West Valley City, Utah 84119

Stormwater Utility Credit Information: 801-963-3406
Stormwater Hotline: 801-963-3334
Stormwater Management Plan Review: 801-963-3318
Stormwater Permit: 801-963-3318

TARGETED POLLUTANTS

■ High Impact
: Medium Impact
9 Low or Unknown Impact

■ Sediment
9 Nutrients
: Heavy Metals
9 Toxic Materials
: Oxygen Demanding Substances
9 Oil & Grease
9 Floatable Materials
9 Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

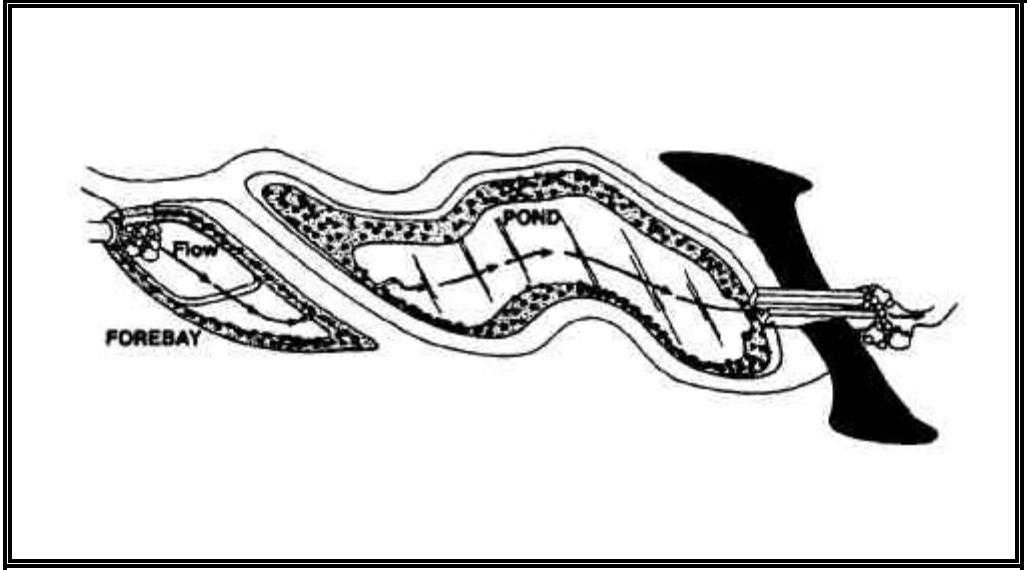
■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High : Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

BMP: Wet Ponds

WP



DESCRIPTION:

A wet pond has a permanent water pool to treat incoming stormwater. An enhanced wet pond includes a pretreatment sediment forebay.

APPLICATION:

< Need to achieve high level of particulate and some dissolved contaminant removal.
< Ideal for large, regional tributary areas.
< Multiple benefits of passive recreation (e.g. bird watching, wildlife habitat).

INSTALLATION/APPLICATION CRITERIA:

< Water depth of 3 to 9 feet.
< Wetland vegetation, occupying 25-50% of water surface area.
< Design to minimize short-circuiting.
< Bypass storms greater than two year storm.
< Be careful when installing wetland vegetation.

LIMITATIONS:

< Concern for mosquitoes and maintaining oxygen in ponds.
< Cannot be placed on steep unstable slopes.
< Need base flow or supplemental water if water level is to be maintained.
< Infeasible in very dense urban areas.

MAINTENANCE:

< Remove floatables and sediment build-up.
< Correct erosion spots in banks.
< Control mosquitoes.
< May require permits from various regulatory agencies, e.g. Corps of Engineers.

CONSIDERATIONS

9 Soils
: Area Required
: Slope
: Water Availability
: Aesthetics
9 Hydraulic Head
: Environmental Side Effects

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TARGETED POLLUTANTS

■ High Impact
: Medium Impact
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■ Sediment
: Nutrients
: Heavy Metals
: Toxic Materials
: Oxygen Demanding Substances
: Oil & Grease
■ Floatable Materials
: Bacteria & Viruses

IMPLEMENTATION REQUIREMENTS

■ Capital Costs
: O&M Costs
: Maintenance
9 Training

■ High **:** Medium **9** Low

Materials Adopted From Salt Lake County Engineering Division Guidance Document

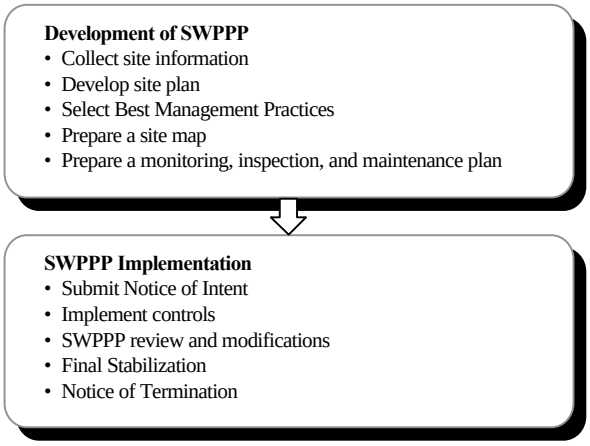
CHAPTER 6

HOW TO PREPARE A SWPPP

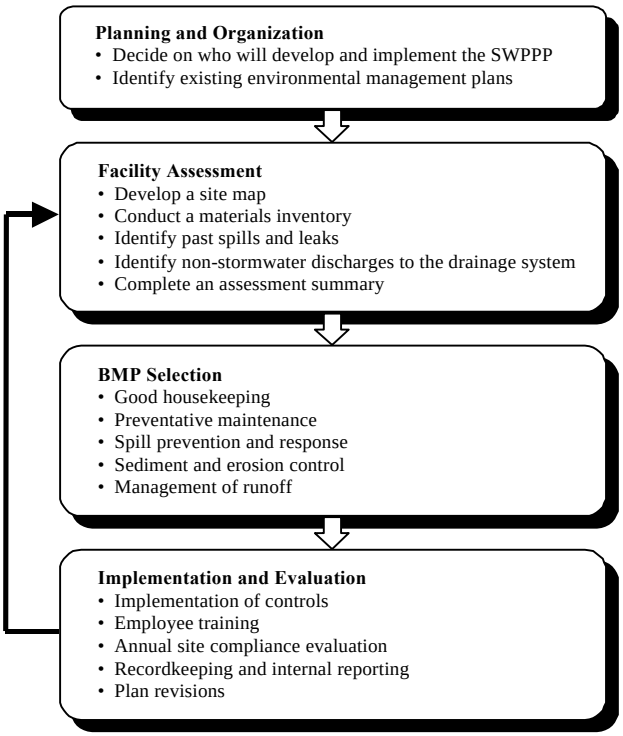
All construction sites which disturb an area of 5 acres or more, currently need a UPDES permit from the State of Utah. As a condition of the permit, a Stormwater Pollution Prevention Plan (SWPPP) must be developed and implemented. All regulated commercial and industrial facilities are required to obtain a permit, develop and implement a SWPPP.

This chapter describes one approach to prepare and implement a SWPPP. Section I describes the procedure involved for construction activities and Section II examines industrial activities. Each section contains a flowchart of the different steps involved in preparing and implementing a SWPPP. The SWPPP flowcharts for both construction and industrial activities are shown below.

Construction Activities.



Industrial Activities.



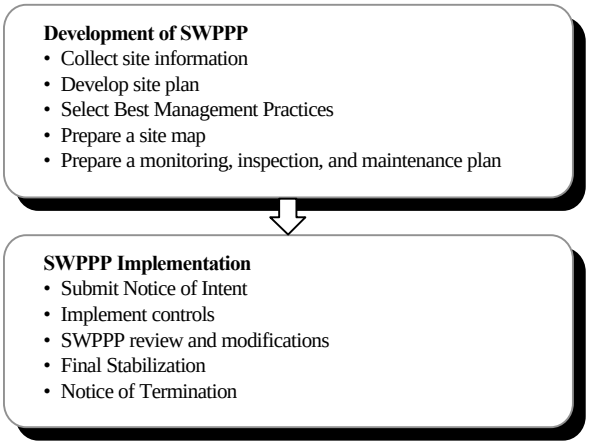
CONSTRUCTION ACTIVITIES

This section describes how to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) for a construction project. The SWPPP is the focus of the UPDES stormwater permit and is the key to controlling pollutants in stormwater discharges.

The preparation of a SWPPP should not be a complicated process. Proper and careful development and implementation of the SWPPP will enhance the benefits of control measures. Responsibility for developing the SWPPP typically lies with the owner of the property that is being developed, or with the owner and operator of the construction project.

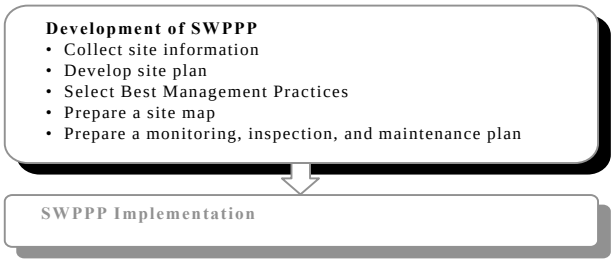
The SWPPP must be prepared before construction commences, ideally during the project planning and design phases. It is recommended that for large sites, the SWPPP be included as part of the bid package. Implementation of the SWPPP begins with the onset of construction activities, as the initial phase of construction is usually clearing and grubbing of the site, which exposes the area to uncontrolled stormwater runoff. Inspection and maintenance of best management practices occurs throughout the life of the construction project and until the site is stabilized.

A two phase process is specified in this section for SWPPP preparation and implementation: development of SWPPP and SWPPP implementation. These phases are designed to identify SWPPP procedures at both preconstruction (development) and construction (implementation) phases.



DEVELOPMENT OF SWPPP

The development stage comprises the collection of construction site information, assessment of that information to determine best management practices and procedures, and compilation of the SWPPP.



COLLECT SITE INFORMATION

Several pieces of information should be collected before a Storm Water Pollution Prevention Plan can be prepared. This information will provide the technical basis for selection of erosion and sedimentation control BMPs and post construction BMPs. A significant amount of this data must be included in the SWPPP, as specified by the UPDES permit. It is suggested that the following items be collected.

Existing Conditions Map - Obtain a topographic site map of the proposed construction area. The map should indicate the existing land use of the site as well as the location of surface waters on or near the site boundaries.

Soils Information - Collect soil information about the site. This information can generally be obtained from the National Resources Conservation Service (NRCS). In some cases, soil sampling may need to be conducted. This information will typically identify soil constraints, design criteria, and slope stability.

Runoff Water Quality - Where possible, obtain stormwater quality data from runoff collected at or near the proposed construction site.

Name of Receiving Water - Identify the receiving water(s) which ultimately collect runoff from your site.

Rainfall Data - Determine the amount of rainfall you anticipate in your design of stormwater management measures.

Measure Site Area - The UPDES stormwater permit requires an estimate of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading, or other activities. The area of the site can usually be found on the deed of sale for the property, the record plat, or site survey. The amount of area to be disturbed will generally need to be estimated based upon contractor knowledge of the construction project.

Determine the Runoff Coefficient - The runoff coefficient is the partial amount of the total rainfall which will become runoff. It provides an estimate of the development's impact on runoff after construction is complete. Consult design guides to obtain average runoff coefficient values for the specific land uses at the site.

DEVELOP SITE PLAN

The site plan will be developed based on information obtained during site collection and assessment and on objectives of the proposed construction project. Several pollution prevention principles should be considered when developing a site plan for the project. They are:

< Disturb the smallest vegetated area possible;

< Keep the amount of cut and fill to a minimum; and

< Limit impacts to sensitive areas such as:

- Steep and/or unstable slopes,

- Surface waters, including wetlands,
- Areas with erodible soils,
- Existing drainage channels.

Once the preliminary design is developed, a narrative description of the nature of the construction activity should be prepared and included in the SWPPP. The narrative should include: a brief description of the project, a sequence of major soil disturbing activities involved in the project, and the approximate project duration.

SELECT BEST MANAGEMENT PRACTICES

At this stage, it should be possible to identify Best Management Practices (BMPs) to be used during the construction activities. BMPs for erosion and sediment control are employed to limit the amount and rate of erosion and to capture the transported sediment before it has the opportunity to enter a stormwater collection system or water course. The selection of BMPs is site-specific with regard to activity, topography, soil conditions, and stormwater facilities. Refer to Chapter 2 of this manual for more information on selection of BMPs for construction activities.

After selection of controls, make a list of each control that you plan to use on the site. Include in this list a description of each control, its purpose, and why it is appropriate in this location.

PREPARE POLLUTION PREVENTION SITE MAP

The owner and/or designer should prepare a site map of the proposed construction area. The map should be of sufficient scale to clearly show on-site features. Additionally, the following features should be delineated:

< Area of soil disturbance;

< Drainage patterns;

< Approximate slopes after major grading;

< Location of structural and nonstructural controls;

< Location of areas where stabilization practices are planned;

< Areas of cut and fill;

< Surface waters (including wetlands);

< Locations where stormwater is discharged to a surface water; and

< The name of the receiving water(s) and the ultimate receiving water(s).

PREPARE A MONITORING, INSPECTION, AND MAINTENANCE PLAN

The construction general permit requires that a monitoring, inspection, and maintenance plan be a component of the SWPPP. This portion of the SWPPP will identify procedures to ensure maintenance of control measures identified in the site plan remain in effective operating condition. To meet these objectives, the monitoring effort should have these elements:

< Site Inspection

< Record Keeping

Site Inspections

Personnel, with knowledge of correct installation and working BMPs, shall inspect areas exposed to soil erosion in accordance with a set inspection schedule. The Utah General Permit requires that inspections occur during construction "...at least once every seven calendar days and within 24 hours of the end of a storm that is 0.5 inches or greater."

Record Keeping

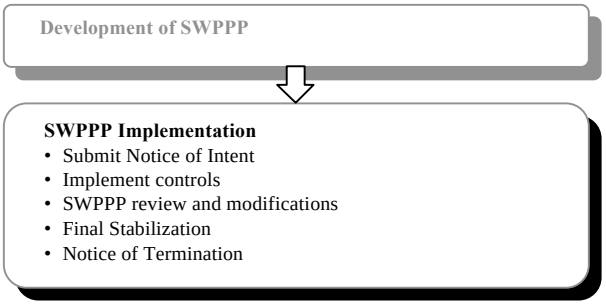
Records of all inspections, compliance certifications, and noncompliance reporting are to be retained for at least three years by the owner/developer.

These inspection reports should include the following information:

- scope of the inspection;
- name and qualifications of personnel inspecting;
- incidents of non-compliance;
- certification that the facility is in compliance with the SWPPP and the State General Permit; and
- signature of the inspector.
- major observations regarding the implementation of controls;

SWPPP IMPLEMENTATION

The implementation stage occurs during the commencement of construction and consists of implementation BMPs, SWPPP review and modifications, and final stabilization of the site.



SUBMIT NOTICE OF INTENT

The construction general permit requires that a Notice of Intent (NOI) be submitted to the Utah Division of Water Quality (UDWQ) prior to the start of construction. The NOI is a notification that a construction project is about to begin, the location of the project, the responsible parties, and a certification that a SWPPP has been prepared and will be followed. The owner of the construction project is responsible for submitting the NOI.

IMPLEMENT CONTROLS

Construct or perform the controls which were selected for the SWPPP at the commencement of the construction project. The controls should be constructed or applied in accordance with standard specifications. If there are no specifications for a specific control measure, good engineering practices should be followed.

SWPPP REVIEW AND MODIFICATIONS

During the course of construction, unanticipated changes may occur which affect the SWPPP, such as schedule changes, phasing changes, staging area modifications, off-site drainage impacts and repeated failures of designed controls. These changes must be made known to the UDWQ and the SWPPP revised accordingly. During the preparation and review of the modified SWPPP, construction may continue with temporary modifications to the erosion and sediment control BMPs.

Revisions to the SWPPP are also required when the properly installed systems are ineffective in the prevention of silt transport off of the site. This may be due to unforseen site conditions or construction techniques which adversely affect the system as designed. Revisions to the SWPPP are also required if there is a new, deleted, or moved activity that could result in a significant amount of pollutants discharged in the stormwater.

FINAL STABILIZATION

As soon as practical after construction activities have been completed in a disturbed area, permanent stabilization (where not already implemented in the BMPs) should commence to prevent further erosion of soil from that area. All disturbed areas of a site (except those portions which are covered by pavement or a structure) should be finally stabilized once all construction activities are completed. Final stabilization is most often attained through seeding, mulching, and use of geotextiles or chemical stabilization methods.

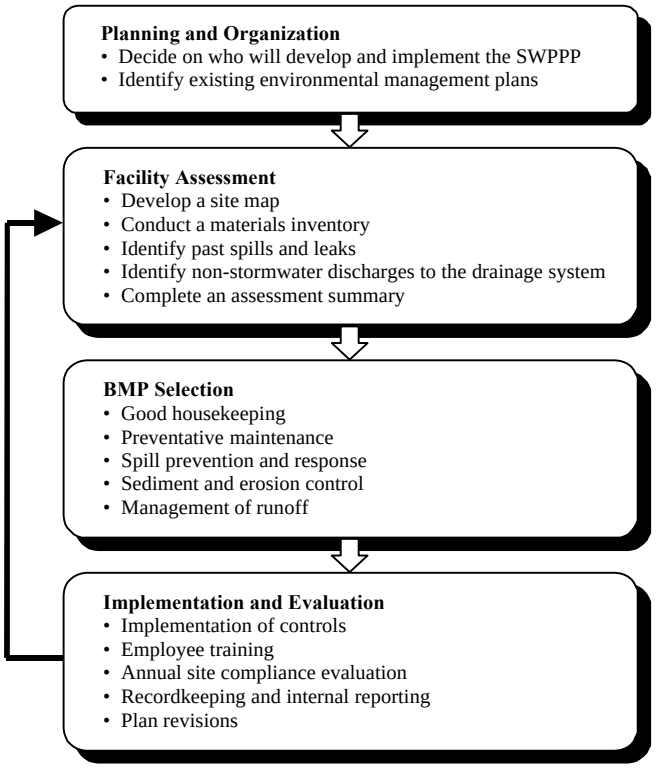
NOTICE OF TERMINATION

The Notice of Termination (NOT) is typically the final task required to comply with the requirements of an UPDES stormwater permit for a construction activity. The NOT communicates to the UDWQ that the construction activity has ceased and the area is stabilized.

INDUSTRIAL ACTIVITIES

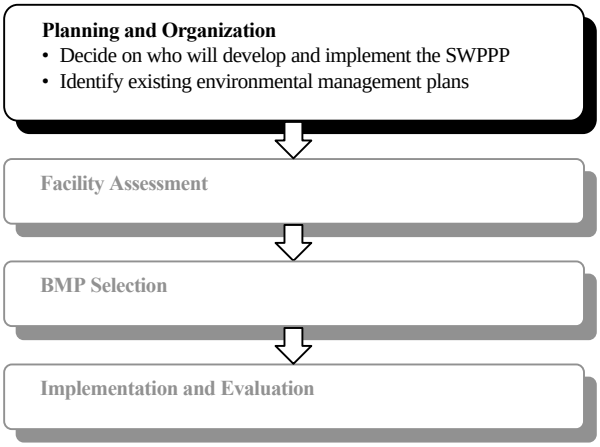
This section describes how to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) for commercial and industrial sites. The discussion is intended to be general in nature so that all industrial facilities will benefit from the information. Facility owners/operators are referred to the UPDES general permit for specific requirements concerning the industrial activities at their site.

Four general phases can describe the process for SWPPP preparation and implementation, they are (1) planning and organization; (2) facility assessment; (3) BMP identification and selection; and (4) implementation and evaluation. These four planning phases are discussed, in turn, in the remainder of this section.



PLANNING AND ORGANIZATION

The planning and organization phase is designed to make developing the SWPPP easier by organizing the staff and making preliminary decisions.



DECIDE WHO WILL DEVELOP AND IMPLEMENT THE SWPPP

The very first step is to decide who will develop and implement the pollution prevention plan. For a small facility, an individual may be sufficient. Large facilities will require pollution prevention teams under the leadership of one individual.

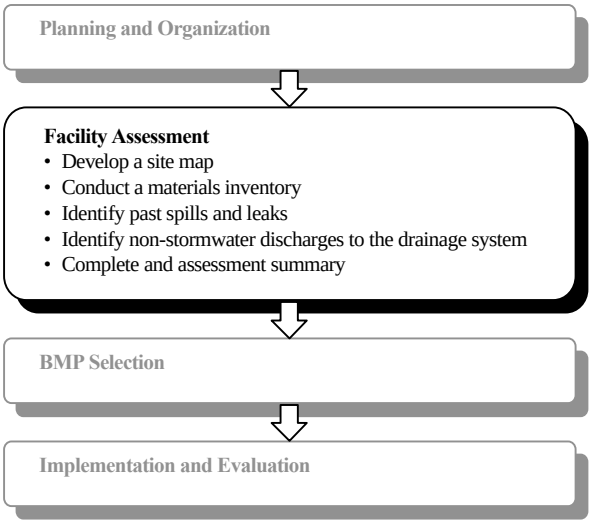
Where setting up a pollution prevention team is appropriate, it is important to identify the key people onsite who are most familiar with the facility and its operations, and to provide adequate structure and direction to the facility's entire stormwater management program. A clear channel of communication should be established throughout the team.

IDENTIFY EXISTING ENVIRONMENTAL MANAGEMENT PLANS

Many commercial and industrial facilities may have already incorporated stormwater management practices into day-to-day operation as a part of an environmental management plan required by other regulations. It is the responsibility of the pollution prevention team to evaluate these other plans to determine which, if any, provisions may be incorporated into the SWPPP.

FACILITY ASSESSMENT

The facility assessment phase consists of looking at the facility/site and determining what materials or practices are or may be a source of contaminants to the stormwater running off the site. This phase is designed to help target the most important pollutant sources for corrective and/or preventive action.



SITE MAP

A facility site map is an illustration of the overall site and location, and should indicate at minimum the information found below.

- All of the buildings at the facility;
- The areas where significant materials are stored, handled or used in process and the types of significant materials associated with each areas;
- The drainage areas associated with each stormwater discharge from the facility/site and the associated ground cover;
- All stormwater related drainage and discharge structures including all conveyance systems and appurtenances;
- Any structural stormwater controls; and
- All surface waters that receive stormwater discharges from the facility.

Locating these features on the map will help to assess the facility for potential areas of concern for stormwater contamination.

MATERIAL INVENTORY

Conduct a material inventory at the site, specifically looking for materials that have been exposed to stormwater and measures that have been taken to prevent the contact of these materials with stormwater. How materials are stored and handled has a bearing on the potential for water pollution. A knowledge of the type and location of materials will provide insight into the pollutants likely to be present.

IDENTIFY PAST SPILLS AND LEAKS

It is required to make a list of significant spills and significant leaks of toxic or hazardous materials that have occurred at the facility. This list provides information on potential sources of stormwater contamination.

IDENTIFY NON-STORMWATER DISCHARGES TO THE DRAINAGE SYSTEM

Certification is needed that the facility has been evaluated for non-stormwater discharges. Connections of non-stormwater discharges are significant sources of water quality problems. With some exceptions such discharges are illegal. Allowable discharges include:

- Discharges from fire fighting activities;
- Fire hydrant flushings;
- Potable water sources including waterline flushings;
- Irrigation drainage;
- Lawn watering;

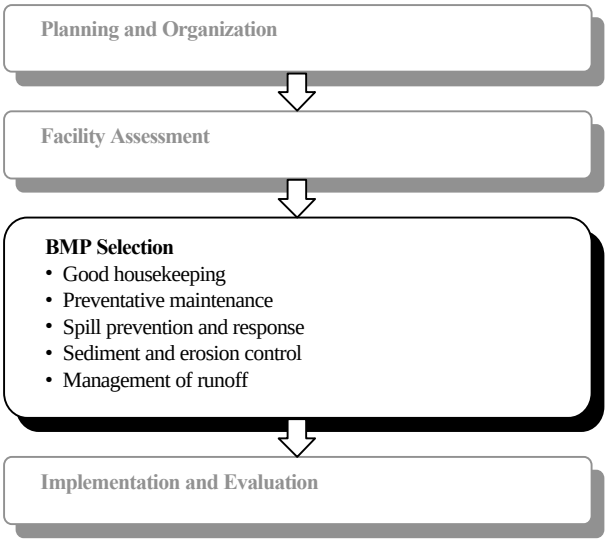
- Uncontaminated ground water;
- Foundation or footing drains where flows are not contaminated with process materials;
- Discharges from springs;
- Routine exterior building washdown which does not use detergents or other compounds;
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used;
- Air conditioning condensate.

COMPLETE AN ASSESSMENT SUMMARY

Compile all of the above information for review and comment by the Pollution Prevention Team. Narratively describe any activities that may contribute to stormwater pollution and what pollutants are present in these areas.

BMP SELECTION

At this point, best management practices can be selected for the facility. BMPs are used to prevent or mitigate pollution from activities at the facility site.



This section will briefly describe "baseline" BMPs. Baseline BMPs are practices that are inexpensive, relatively simple, and applicable to a wide variety of industries and activities. Selection of more specific industrial BMPs is contained in Chapter 5.

GOOD HOUSEKEEPING

Good Housekeeping practices are simply maintaining a safe, orderly, and clean work environment. Some methods to accomplish this include:

- Improving operation and maintenance of machinery and processes;
- Implement careful storage practices;
- Keep a current up-to-date inventory, and label all containers;
- Schedule routine cleanup operations; and
- Train employees on good housekeeping techniques.

PREVENTATIVE MAINTENANCE

A program must be developed that includes inspections and routine maintenance of all equipment, including tanks, drums, and containers, and other facility operations. Remember, the best way to stop a spill is to prevent the spill from happening in the first place.

SPILL PREVENTION AND RESPONSE

In areas that have been designated with a high possibility of a leak or spill, permittees should ensure that employees are aware of correct response procedures, including material handling and storage requirements. Spill cleanup equipment must be on-site at high risk locations. A spill plan should be formulated in case of an emergency, including notifying the appropriate authorities.

SEDIMENT AND EROSION CONTROL

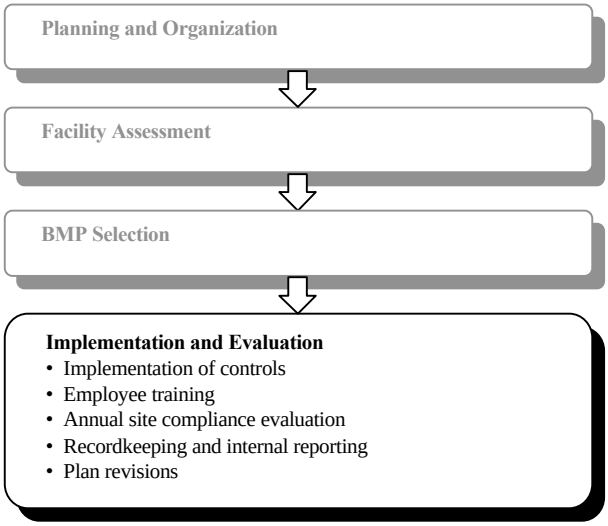
The SWPPP must identify activities that present a potential for significant soil erosion, and any measures taken to control such erosion.

MANAGEMENT OF RUNOFF

The SWPPP should also include any existing stormwater controls such as vegetative swales, infiltration trenches, or detention ponds.

IMPLEMENTATION AND EVALUATION

The last phase is development of a program to implement the selected control measures and to evaluate their effectiveness.



IMPLEMENTATION OF CONTROLS

Implementing the plan will involve:

< Develop a schedule for implementation;

< Delegate responsibilities to specific individuals for certain aspects of the plan and monitoring implementation; and

< Ensure that management approves the schedule and strategy, and schedule specific times to report progress to management.

EMPLOYEE TRAINING

Employee training is essential to effective implementation of the SWPPP. The purpose of a training program is to teach personnel at all levels of responsibility the components and goals of the Storm Water Pollution Prevention Plan. The training program should cover such topics as spill prevention and response, good housekeeping, and material management practices.

ANNUAL SITE COMPLIANCE EVALUATION

Each year qualified personnel should conduct a site compliance evaluation to inspect all drainage areas for evidence of pollutants, evaluate good housekeeping measures, observe structural measures, and inspect all sites for problems. The plan should be revised if needed within 2 weeks of inspection, and changes should be implemented within 12 weeks. A report of all findings should be prepared, signed, and kept with the SWPPP.

RECORDKEEPING AND INTERNAL REPORTING

Records of all spills, leaks, inspections, and maintenance activities should be maintained for at least one year after the permit expires. Dates, times, weather conditions, causes, and resulting problems should all be noted.

PLAN REVISIONS

Any change in a facility design, construction, or maintenance plan will necessitate changes in the SWPPP.

REFERENCES

U.S. Environmental Protection Agency. September 1992. "Storm Water Management for Construction Activities - Developing Pollution Prevention Plans and Best Management Practices," EPA-832-R-92-005.

U.S. Environmental Protection Agency. September 1992. "Storm Water Management for Industrial Activities - Developing Pollution Prevention Plans and Best Management Practices," EPA-832-R-92-006.

APPENDICES

STORMWATER RESOURCES GLOSSARY

STORMWATER RESOURCES

West Valley City Public Works

Storm Water Utility. 963-3406

Informational Hotline 963-3334

Engineering 963-3224

Environmental Protection Agency (EPA) Region VIII . . . . . (800) 227-8917

Army Corps of Engineers . . . . . (801) 295-8380

Salt Lake City-County Health Department

Water Quality and Hazardous Waste 313-6700

Environmental Health 313-6600

Utah Department of Environmental Quality

Division of Water Quality 538-6146

Division of Environmental Response and Remediation 536-4100

Division of Air Quality 536-4000

Solid and Harzardous Waste - Used Oil Hotline . . . . . (800) 458-0145

Utah Division of Natural Resources

General Information 539-4001

Salt Lake County Public Works

Engineering 468-2711

GLOSSARY

Berm: An earthen mound used to direct the flow of runoff around or through a structure.

Best Management Practices (BMPs): Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Bioengineering: Restoration or reinforcement of slopes and stream banks with living plant materials.

Conveyance System: Any channel or pipe for collecting and directing the stormwater.

Culvert: A covered channel or large diameter pipe that directs water flow below the ground surface.

Degradation: (Biological or chemical) The breakdown of chemical compounds into simpler substances, usually less harmful than the original compound, as with the degradation of a persistent pesticide. (Geological) Wearing down by erosion. (Water) The lowering of the water quality of a watercourse by an increase in the amount of pollutant(s).

Dike: An embankment to confine or control water, often built along the banks of a river to prevent overflow of lowlands; a levee.

Discharge: The release of stormwater or other substance from a conveyance system or storage container.

Drainage: Refers to the collection, conveyance, containment, and/or discharge of surface and stormwater runoff.

Erosion: The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by land-clearing practices related to farming, residential or industrial development, road building, or timber-cutting.

Eutrophication: The process of over-enrichment of waters by nutrients, often typified by the presence of algal blooms.

Fibric Peats: Those peats in which the undecomposed fibrous organic materials are easily identifiable. The most common fibric peat is sphagnum moss, which is extremely acidic.

Fill: A deposit of earth material placed by artificial means.

First Flush: The delivery of a disproportionately large load of pollutants during the early part of storms due to the rapid runoff of accumulated pollutants.

Forebay: An extra storage area provided near the inlet of a BMP to trap incoming sediments before they accumulate in a pond BMP.

Gabion: A large rectangular box of heavy gage wire mesh, which holds large cobbles and boulders. Used in streams and ponds to change flow patterns, stabilize banks, or prevent erosion.

General Permit: A permit issued under the NPDES program to cover a class or category of stormwater discharges.

Grading: The cutting and/or filling of the land surface to a desired slope or elevation.

Hazardous Waste: By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (flammable, corrosivity, reactivity, or toxicity), or appears on special EPA lists.

Heavy Metals: Metals of high specific gravity, present in municipal and industrial wastes, that pose long-term environmental hazards. Such metals include cadmium, chromium, cobalt, copper, lead, mercury, nickel, and zinc.

Hemic Peats: Peats which are intermediate in their properties between those of the fibric and sapric categories. They are typically more decomposed than fibric peats but less so than sapric. Similarly, hydraulic conductivity and color of hemic peat are generally intermediate between those of the other two peat categories.

Hydraulic Head: The height of water above any plain of reference.

Individual Permit: A permit issued under the NPDES program for a specific facility, whereby the unique characteristics of that facility may be addressed through the imposition of special conditions or requirements.

Infiltration: The downward movement of water from the surface to the subsoil. The infiltration capacity is expressed in terms of inches/hour.

Ingress/Egress: The points of access to and from a property.

Inlet: An entrance into a ditch, storm sewer, or other waterway.

Mulch: A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Nonpoint Source: Pollution caused by diffuse sources (not a single location such as a pipe) such as agricultural or urban runoff.

NPDES (National Pollutant Discharge Elimination System): EPA's program to control the discharge of pollutants to waters of the United States.

NPDES Permit: An authorization, or license, or equivalent control document issued by EPA or an approved state agency to implement the requirements of the NPDES program.

Off-site: Any area lying upstream of the site that drains onto the site and any area lying downstream of the site to which the site drains.

On-site: The entire property that includes the proposed development.

Outfall: The point, location, or structure where wastewater or drainage discharges from a sewer pipe, ditch, or other conveyance to a receiving body of water.

Point Source: Any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.

Plat: A map or representation of a subdivision showing the division of a tract or parcel of land into lots, blocks, streets, or other divisions and dedications.

Pollutant: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

Receiving Waters: Bodies of water or surface water systems receiving water from upstream constructed (or natural) systems.

Retention: The holding of runoff in a basin without release except by means of evaporation, infiltration, or emergency bypass.

Riparian: A relatively narrow strip of land that borders a stream or river.

Riprap: A combination of large stone, cobbles and boulders used to line channels, stabilize banks, reduce runoff velocities, or filter out sediment.

Runon: Stormwater surface flow or other surface flow which enters property other than that where it originated.

Runoff: That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into the receiving waters.

Sapric Peat: Includes the most highly decomposed peat materials. In sapric peats, the original plant fibers have mostly disappeared. The water-holding capacity of sapric peat is commonly less than that of either fibric or hemic peat. Sapric peats are typically very dark gray to black in color and are quite stable in their physical properties.

Sedimentation: The process of depositing soil particles, clays, sands, or other sediments that were picked up by runoff.

Sheet Flow: Runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel.

Sorption: The physical or chemical binding of pollutants to sediment or organic particles.

Source Control: A practice or structural measure to prevent pollutants from entering stormwater runoff or other environmental media.

Stabilization: The proper placing, grading and/or covering of soil, rock, or earth to ensure its resistance to

erosion, sliding, or other movement.

Storm Drain: A slotted opening leading to an underground pipe or open ditch for carrying surface runoff.

Stormwater: Rainfall runoff, snow melt runoff, and drainage. It excludes infiltration.

Swale: An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales direct stormwater flows into primarily drainage channels and allow some of the stormwater to infiltrate into the ground surface.

Treatment: The act of applying a procedure or chemicals to a substance to remove undesirable pollutants.

Treatment Control BMP: A BMP that is intended to remove pollutants from stormwater.

Turbidity: Describes the ability of light to pass through water. The cloudy appearance of water is caused by suspended and colloidal matter (particles).

Urban Runoff: Stormwater that passes through and out of developed areas to a stream or other body of water.

Wetlands: An area that is regularly saturated by surface or ground water and subsequently characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include: swamps, bogs, marshes, and estuaries.